TM 11-5036

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

POWER SUPPLIES PP-109/GR AND PP-112/GR

DEPARTMENT OF THE ARMY • MARCH 1951

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DEPARTMENT OF THE ARMY *MARCH 1951*

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For explanation of distribution formula see SR 310–90–1.

WARNING

HIGH VOLTAGE

is produced in the operation
of this equipment.

DEATH ON CONTACT

may result if operating personnel
fail to observe safety precautions.

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First Aid for Electric Shock

RESCUE.

In case of electric shock, shut off the high voltage at once and ground the circuits. If the high voltage cannot be turned off without delay, free the victim from contact with the live conductor as promptly as possible. Avoid direct contact with either the live conductor or the victim's body. Use a dry board, dry clothing, or other nonconductor to free the victim. An ax may be used to cut the high-voltage wire. Use extreme caution to avoid the resulting electric flash.

SYMPTOMS.

a. Breathing stops abruptly in electric shock if the current passes through the breathing center at the base of the brain. If the shock has not been too severe, the breath center recovers after a while and normal breathing is resumed, provided that a sufficient supply of air has been furnished meanwhile by artificial respiration.

b. The victim is usually very white or blue. The pulse is very weak or entirely absent and unconsciousness is complete. Burns are usually present. The victim's body may become rigid or stiff in a very few minutes. This condition is due to the action of electricity and is not to be considered rigor mortis. Artificial respiration must still be given, as several such cases are reported to have recovered. The ordinary and general tests for death should never be accepted.

TREATMENT.

a. Start artificial respiration immediately. At the same time send for a medical officer, if assistance is available. Do not leave the victim unattended. Perform artificial respiration at the scene of the accident, unless the victim's or operator's life is endangered from such action. *In this case only*, remove the victim to another location, but no farther than is necessary for safety. If the new location is more than a few feet away, artificial respiration should be given while the victim is being moved. If the method of transportation prohibits the use of the Shaeffer prone pressure method, other methods of resuscitation may be used. Pressure may be exerted on the front of the victim's diaphragm, or the direct mouth-to-mouth method may be used. Artificial respiration, once started, must be continued, without loss of rhythm.

b. Lay the victim in a prone position, one arm extended directly overhead, and the other arm bent at the elbow so that the back of the hand supports the head. The face should be turned away from the bent elbow so that the nose and mouth are free for breathing.

c. Open the victim's mouth and remove any foreign bodies, such as false teeth, chewing gum, or tobacco. The mouth should remain open, with the tongue extended. Do not permit the victim to draw his tongue back into his mouth or throat.

d. If an assistant is available during resuscitation, he should loosen any tight clothing to permit free circulation of blood and to prevent restriction of breathing. He should see that the victim is kept warm, by applying blankets or other covering, or by applying hot rocks or bricks wrapped in cloth or paper to prevent injury to the victim. The assistant should also be ever watchful to see that the victim does not swallow his tongue. He should continually wipe from the victim's mouth any frothy mucus or saliva that may collect and interfere with respiration.

e. The resuscitating operator should straddle the victim's thighs, or one leg, in such manner that:

(*1*) the operator's arms and thighs will be vertical while applying pressure on the small of the victim's back;

(*2*) the operator's fingers are in a natural position on the victim's back with the little finger lying on the last rib;

(*3*) the heels of the hands rest on either side of the spine as far apart as convenient without allowing the hands to slip off the victim;

(*4*) the operator's elbows are straight and locked.

f. The resuscitation procedure is as follows:

(*1*) Exert downward pressure, not exceeding 60 pounds, for 1 second.

(*2*) Swing back, suddenly releasing pressure, and sit on the heels.

(*3*) After 2 seconds rest, swing forward again, positioning the hands exactly as before, and apply pressure for another second.

g. The forward swing, positioning of the hands, and the downward pressure should be accomplished in one continuous motion, which requires 1 second. The release and backward swing require 1 second. The addition of the 2-second rest makes a total of 4

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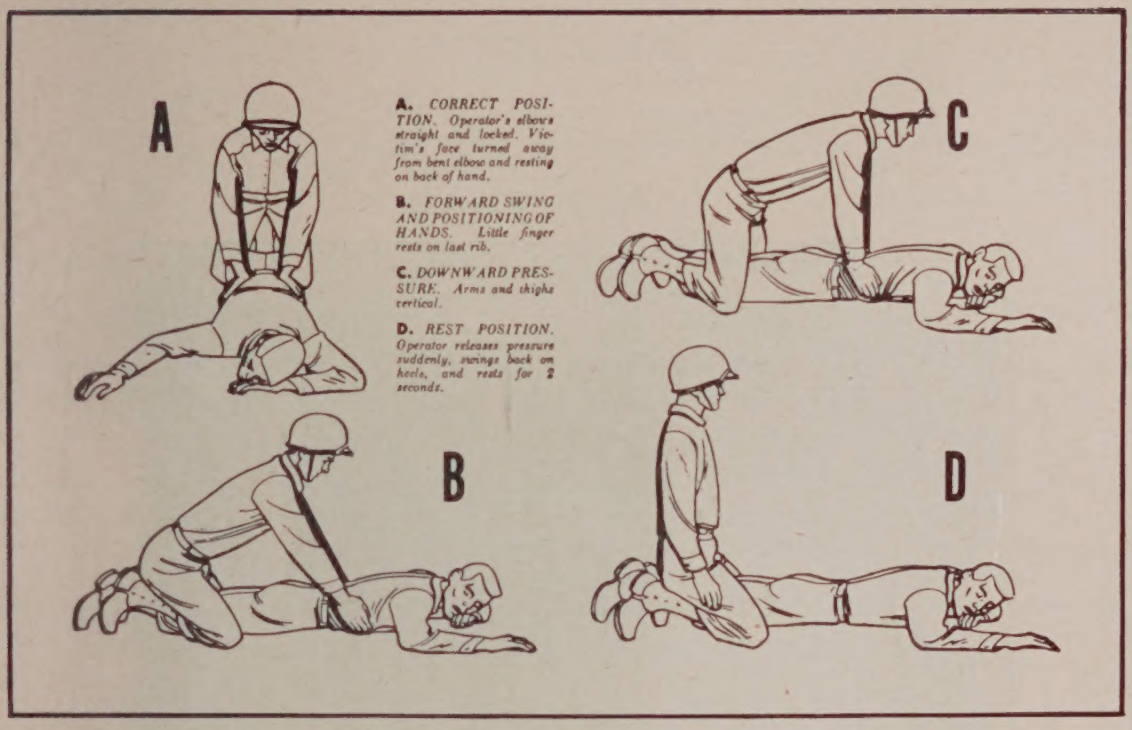
A
B
C
D
A. CORRECT POSITION. Operator's elbows straight and locked. Victim's face turned away from bent elbow and resting on back of hand.
B. FORWARD SWING AND POSITIONING OF HANDS. Little finger rests on last rib.
C. DOWNWARD PRESSURE. Arms and thighs vertical.
D. REST POSITION. Operator releases pressure suddenly, swings back on heels, and rests for 2 seconds.

seconds for a complete cycle. Until the operator is thoroughly familiar with the correct cadence of the cycle, he should count the seconds aloud, speaking distinctly and counting evenly in thousands. Example: one thousand and one, one thousand and two, etc.

h. Artificial respiration should be continued until the victim regains normal breathing or is pronounced dead by a medical officer. Since it may be necessary to continue resuscitation for several hours, relief operators should be used if available.

RELIEVING OPERATOR.

The relief operator kneels beside the operator and follows him through several complete cycles. When the relief operator is sure he has the correct rhythm, he places his hands on the operator's hands without applying pressure. This indicates that he is ready to take over. On the backward swing, the operator moves and the relief operator takes his position. The relieved operator follows through several complete cycles to be sure that the new operator has the correct rhythm. He remains alert to take over instantly if the new operator falters or hesitates on the cycle.

STIMULANTS.

a. If an inhalant stimulant is used, such as aromatic spirits of ammonia, the individual administering the stimulant should first test it himself to see how close he can hold the inhalant to his own nostril for comfortable breathing. Be sure that the inhalant is not held any closer to the victim's nostrils, and then for only 1 or 2 seconds every minute.

b. After the victim has regained consciousness, he may be given hot coffee, hot tea, or a glass of water containing ½ teaspoon of aromatic spirits of ammonia. *Do not give any liquids to an unconscious victim.*

CAUTIONS.

a. After the victim revives, keep him LYING QUIETLY. Any injury a person may have received may cause a condition of shock. Shock is present if the victim is pale and has a cold sweat, his pulse is weak and rapid, and his breathing is short and gasping.

b. Keep the victim lying flat on his back, with his head lower than the rest of his body and his hips elevated. Be sure that there is no tight clothing to restrict the free circulation of blood or hinder natural breathing. Keep him warm and quiet.

c. A resuscitated victim must be watched carefully as he may suddenly stop breathing. *Never leave a resuscitated person alone until it is CERTAIN that he is fully conscious and breathing normally.*

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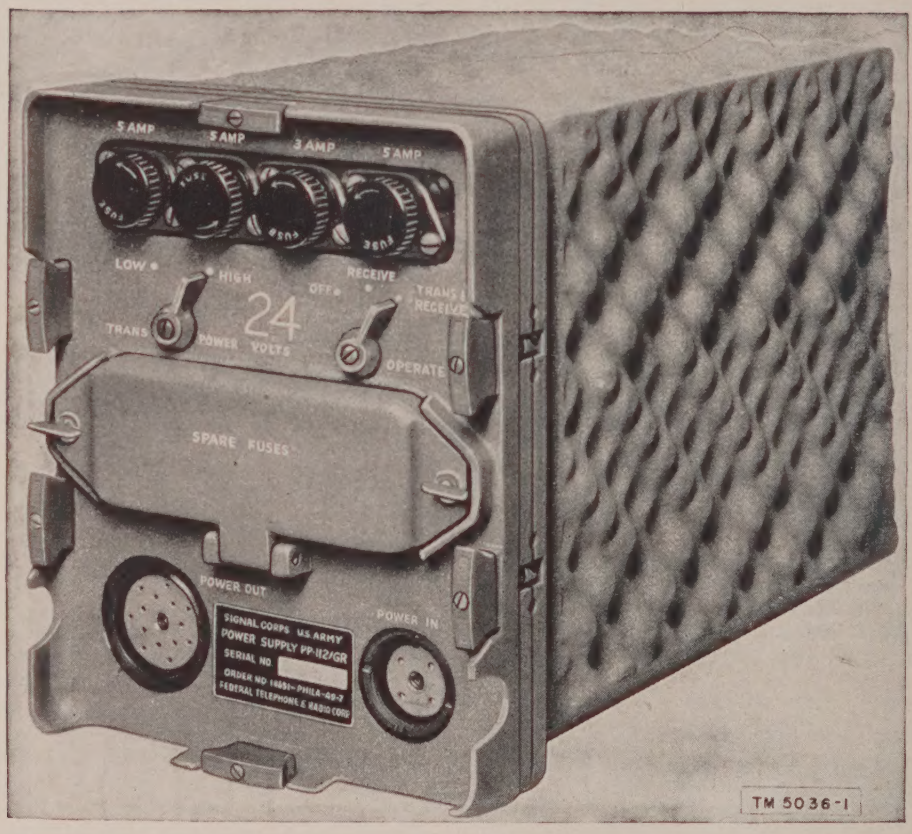


Figure 1. Power Supply PP–112/GR, front view.

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1. Purpose and Scope

a. This technical manual contains information pertaining to the description and theory of Power Supplies PP–109/GR and PP–112/GR, and provides instructions for the maintenance, repair, and test of these units. Two appendixes furnish a list of references and an identification table of parts.

b. The two power supplies listed above are alike in most respects, and they are discussed simultaneously in this manual. Where specific differences exist between the units, these differences are discussed with specific reference to the particular unit involved.

2. Forms and Records

The following forms will be used for reporting unsatisfactory conditions of matériel and equipment, or improper preservation, packaging, packing, marking, loading, stowage, or handling thereof.

a. DD Form 6, Report of Damaged or Improper Shipment (Reports Control Symbol CS GLD–66), will be filled out and forwarded as prescribed in SR 745–45–5.

b. DA AGO Form 468, Unsatisfactory Equipment Report (Reports Control Symbol CS GLD–247), will be filled out and forwarded to the Office of the Chief Signal Officer, as prescribed in SR 700–45–5.

c. Use other forms and records as authorized.

Section II. DESCRIPTION AND DATA

3. Purpose and Use
(fig. 1)

a. Power Supplies PP–109/GR and PP–112/GR are vibrator type power supplies which derive power from 12- and 24-volt storage batteries, respectively, to supply the plate, filament, bias, and relay voltages listed in paragraph 5.

b. The units are designed specifically to provide operating power for any one of Receiver-Transmitters RT–66/GRC, RT–67/GRC, and RT–68/GRC. Means are provided for energizing the power circuits for the receiver only, or the power circuits for both the receiver and the transmitter. In addition, provisions are made to allow either high- or low-power operation of the receiver-transmitters.

c. When used to supply power for receiving only, the power supplies can be operated continuously. When used alternately for transmitting and receiving, the power supplies should not be used for more than 5 minutes of continuous operation. If the power supplies are used to furnish transmitter power continuously for 5 minutes, an interval of at least 15 minutes should be allowed before transmitting again. During the 15-minute interval, the power supplies can be used to furnish power for reception. The intervals may be shorter than 15 minutes when transmission has not been continuous for 5 minutes.

4. System Application

a. Power Supply PP–109/GR or PP–112/GR is used in conjunction with Receiver-Transmitter RT–66/GRC, RT–67/GRC, or RT–68/GRC in any storage battery installation. Figure 2 is a simplified block diagram of a system in which the power supply is used to provide the necessary operating potentials.

b. Application of battery power to the power supply is under control of the OPERATE switch. When this switch is on RECEIVE or TRANS & RECEIVE, plate and filament voltages for the receiver are available at the POWER OUT connector terminals.

c. When the power supply is turned on, a relay supply voltage and a control lead voltage are made available at the POWER OUT connector. The relay supply voltage is utilized to energize control relays in the receiver-transmitter when an external control is closed.

d. Plate and filament voltages for the transmitter are controlled by the OPERATE switch and

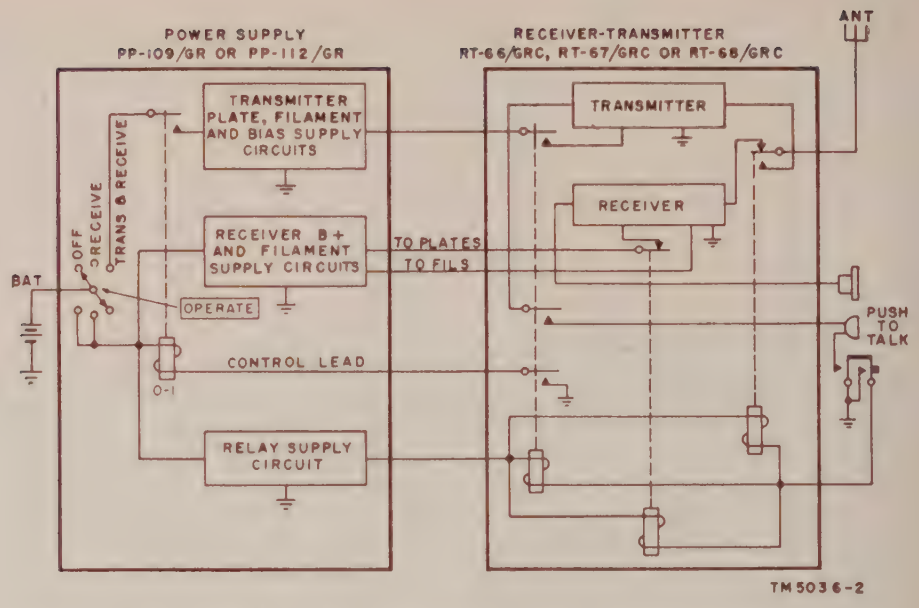


Figure 2. Power Supply PP–112/GR or PP–109/GR, system application, simplified diagram.

another switch on the operator's microphone or control board. When the OPERATE switch is in the TRANS & RECEIVE position, and the external control is activated, first the receiver-transmitter relays are energized and then the transmitter power supply relay is energized. This causes transmitter plate and filament voltages to become available (fig. 2). The operation of the power supply in any system is described in the technical literature for the particular system. Details for the operation of the controls for the power supply are given in chapter 2.

5. Technical Characteristics

Rated input voltage:

Power Supply
PP–112/GR---------- 25.2 volts dc (direct current).

Power Supply
PP–109/GR---------- 12.6 volts dc.

Rated input current:

Power Supply
PP–112/GR---------- 7.0 amperes.

Power Supply
PP–109/GR---------- 11.5 amperes.

Filament and control circuit power drains:

	High power	*Low power*
Receiver filaments	6.3 volts dc (595 ma (milliamperes))	6.3 volts dc (595 ma)
Transmitter filaments	6.3 volts dc (1.415 amperes)	6.3 volts dc (1.415 amperes)
Relay control circuits	5.6 volts dc (431 ma)	5.6 volts dc (431 ma)

Plate, screen, and bias power drains:

Transmit		*Receive*	
HIGH	LOW	HIGH	LOW
450 volts dc (75 ma)	200 volts dc (33.5 ma)	0 volts	0 volts
250 volts dc (11.5 ma)	150 volts dc (4.8 ma)	0 volts	0 volts
150 volts dc (37.5 ma)	90 volts dc (22.5 ma)	0 volts	0 volts
100 volts dc (19 ma)	90 volts dc (17 ma)	105 volts dc (20 ma)	105 volts dc (20 ma)
85 volts dc (70.7 ma)	90 volts dc (75 ma)	85 volts dc (50.5 ma)	85 volts dc (50.5 ma)
−27 volts dc (2 ma)	0 volts	0 volts	0 volts

Adaptability to service conditions:

Altitude	10,000 feet, maximum.
Shocks and vibration	Will stand shocks, strains, and vibration in a vehicle operating over rugged terrain.
Weather and climate	Immersionproofed and fungiproofed.
Normal operating temperature	From −40°C (−40°F) to +55°C (+130°F).

6. Description

a. General. Power Supply PP–112/GR (fig. 1) is a vibrator type power supply. It consists of a panel-and-chassis assembly inclosed in an immersionproof metal case. The panel-and-chassis assembly is fastened to the case by six Dzus fasteners, which are accessible from the front. The over-all dimensions of the unit are 9¼ inches high by 7¼ inches wide by 12⅞ inches long. The total weight of the unit with case is about 35 pounds. The exterior of the unit is finished with an olive drab wrinkle paint. The information in this paragraph applies equally to Power Supplies PP–112/GR and PP 109 GR except where mechanical and electrical differences in the latter unit require special description.

b. Case. The metal case consists of an aluminum outer skin welded to an aluminum box. The outer skin has been wrinkled to increase its resistance to shock. Runners on the bottom of the case permit the case to be installed and locked on the mounting base of the equipment with which the power supply is to be used.

c. Front Panel. The front panel is an aluminum casting finished in an olive drab wrinkle paint. All operating controls, fuses, spare fuse holder, cable connectors, and Dzus fasteners are mounted on the front of the panel. The panel is recessed to prevent damage to the controls due to impact.

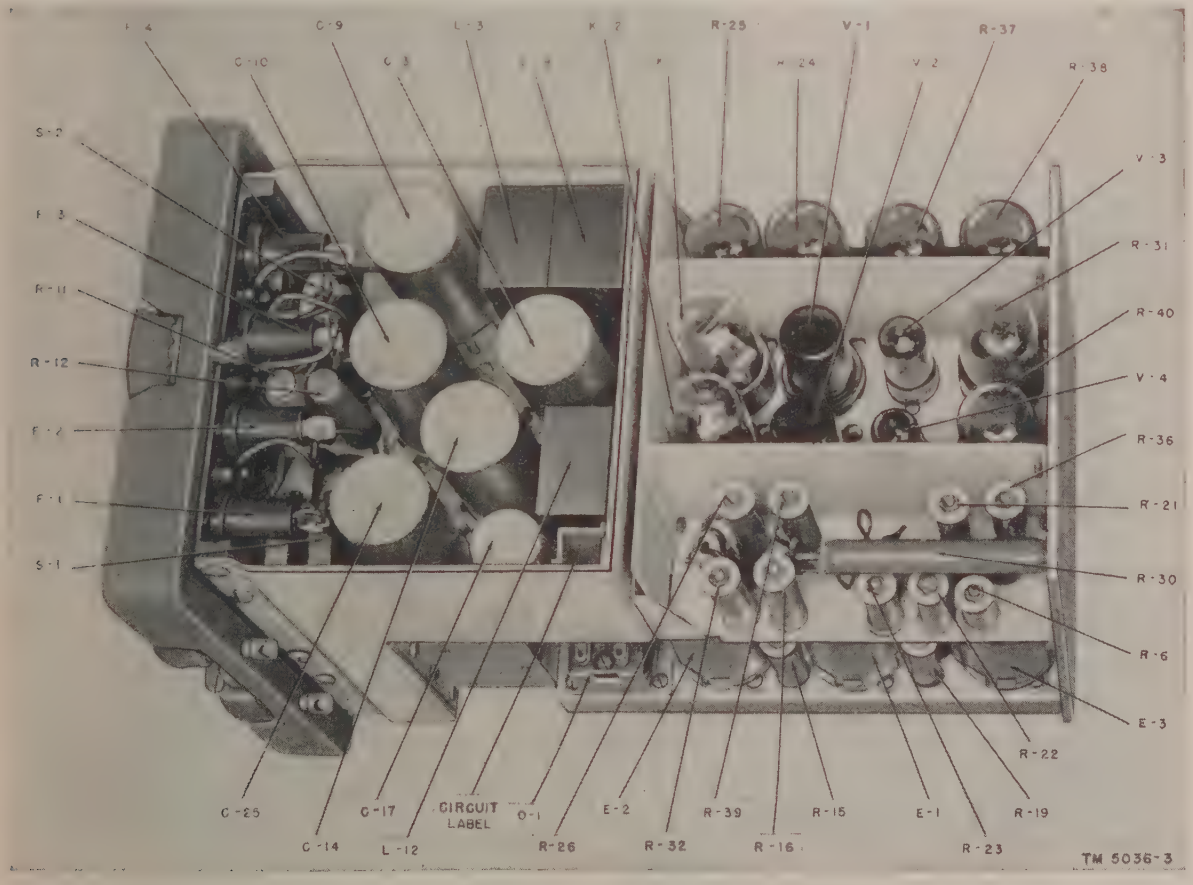


Figure 3. Power Supply PP–112/GR, top of chassis.

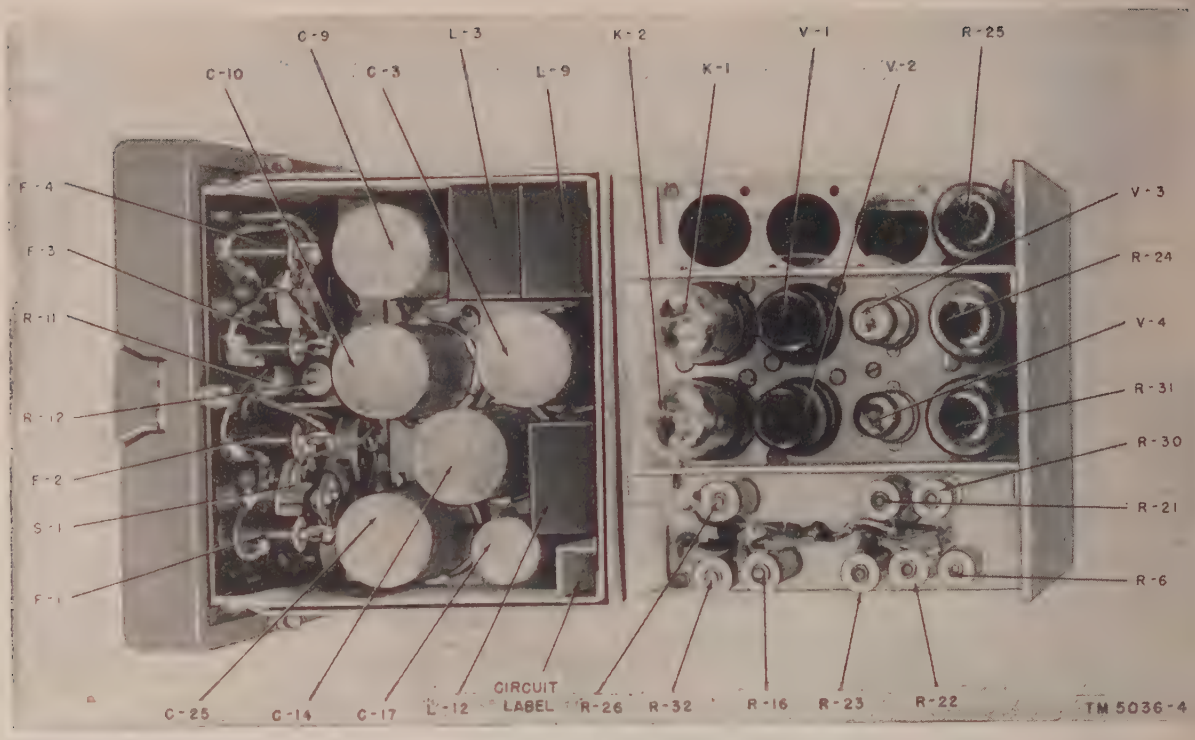


Figure 4. Power Supply PP–109/GR, top of chassis.

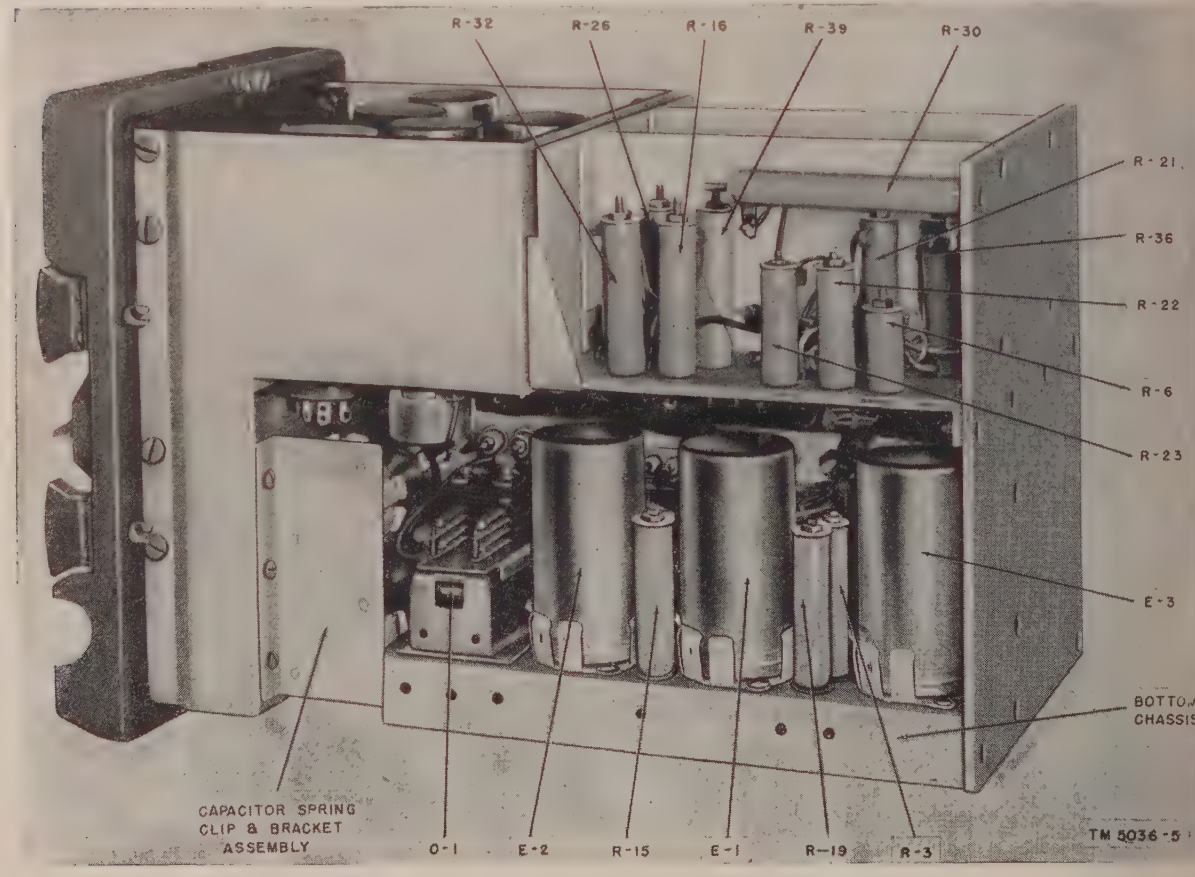


Figure 5. Power Supply PP–112/GR, right-hand side view.

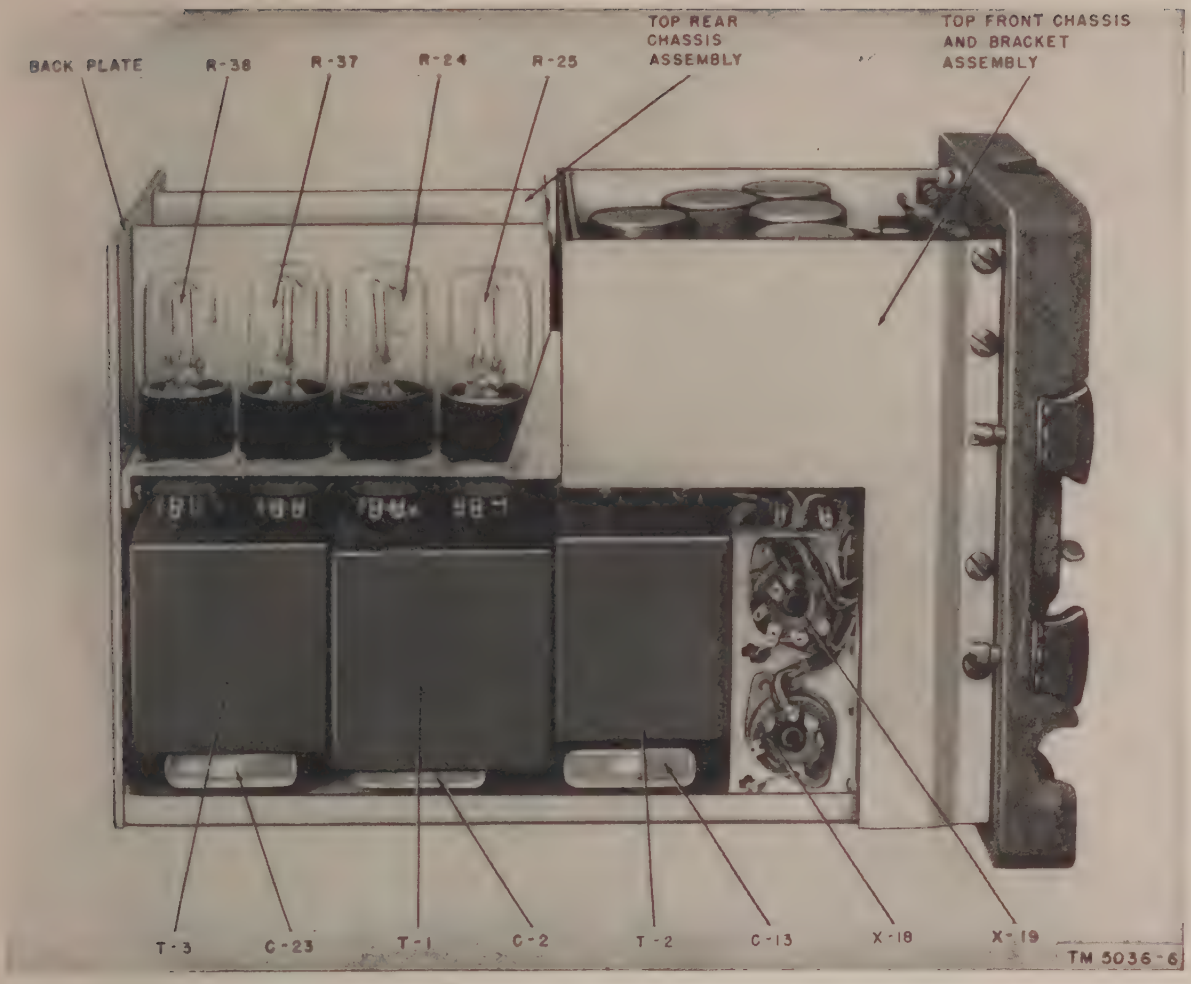


Figure 6. Power Supply PP–112/GR, left-hand side view.

The use of controls, connectors, and other components mounted on the front panel is discussed in detail in paragraph 7.

d. Chassis Assembly (figs. 3 through 6, 10, and 11). A top view of Power Supply PP–112/GR without cover is shown in figure 3. A similar view of Power Supply PP–109/GR is shown in figure 4. A comparison of these two figures shows that the two units are nearly alike in appearance, except for the number of ballast tubes and the number and size of resistors. The side views of Power Supply PP–112/GR (figs. 5 and 6) are equally representative of Power Supply PP–109/GR, except for the differences noted in figures 3 and 4. Bottom views of the two power supplies are shown in figures 10 and 11. The chassis assembly is composed of several sections, as follows:

(1) *Front chassis assembly.* The front chassis assembly consists of a chassis and an outer bracket (fig. 6). On the chassis are mounted the large electrolytic capacitors and the chokes composing the a-c (alternating-current) ripple filter assembly (fig. 3). The bracket mounts a shelf for two large plug-in type electrolytic capacitors (C–27 and C–30) and a removable clamp assembly for retaining these capacitors in their sockets under vibration stresses (figs. 10 and 11). The chassis and the outer bracket provide an air space around the filter components to insulate them from the heat produced by the tubes and large resistors mounted on the rear of the chassis assembly. A recess in the portion of the bracket facing the front panel serves to inclose the panel-mounted components and to mount the r-f (radio-frequency) filter assembly (fig. 12).

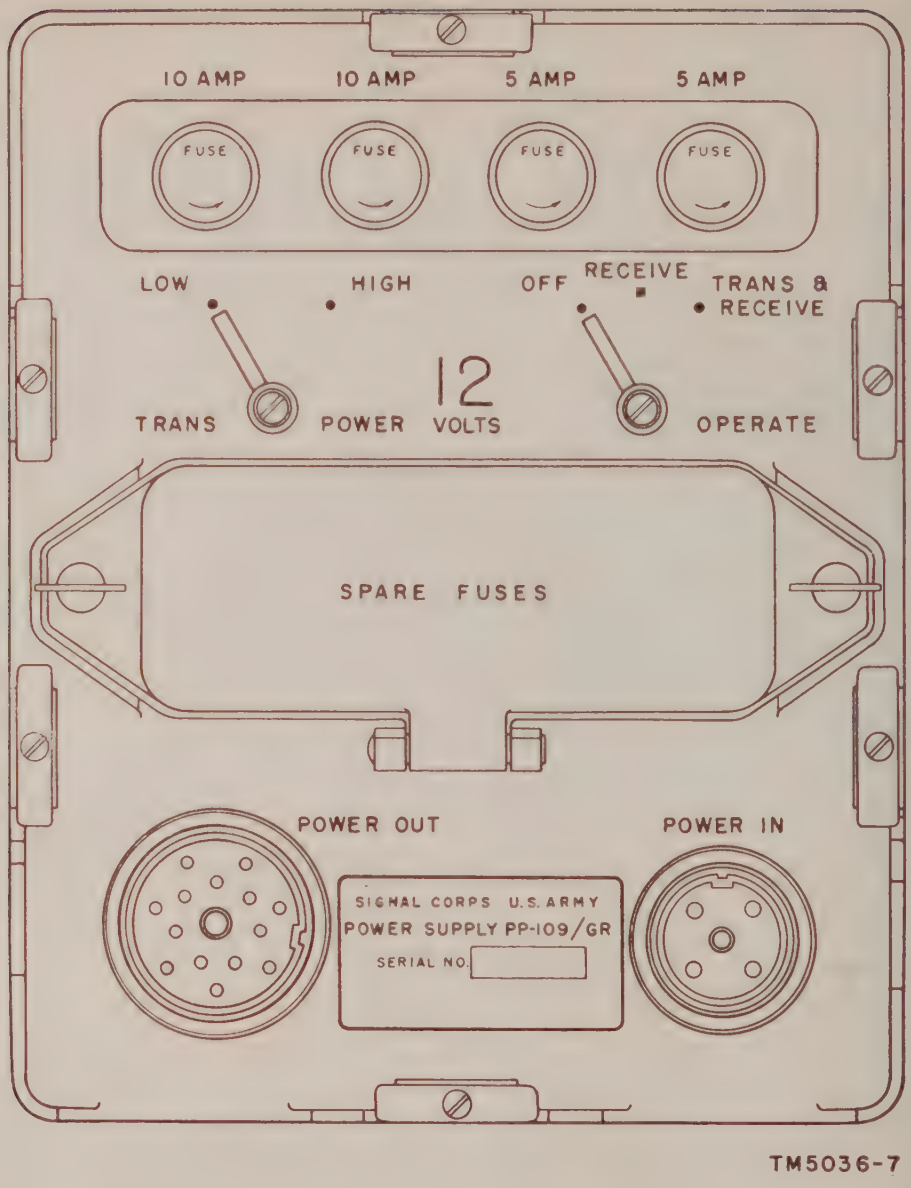


Figure 7. Power Supply PP–109/GR, controls, fuses, and connectors.

(2) *Rear chassis assembly.* The rear chassis assembly consists of a chassis and rear plate (figs. 3, 6, and 12). The chassis mounts the heat-producing parts of the power supply, namely, the ballast tubes, thermal relays, rectifier tubes, voltage regulator tubes, and most of the large resistors. Small angle brackets attach the chassis to the bracket around the front chassis (see (1) above). The chassis is made of heavy aluminum and is attached to the back plate to facilitate heat conduction toward the rear of the unit and away from the front chassis components. The top of the rear chassis is separated into three compartments by aluminum walls or baffles, for the purpose of reflecting heat toward the outer case and facilitating heat dissipation toward the back plate and the power supply outer cover.

(3) *Bottom chassis assembly.* The removable bottom chassis assembly, mounted below the front and rear chassis, is attached by means of machine screws to the lower ver-

tical portion of the outer bracket and to the back plate. The bottom chassis consists of two brackets (figs. 5, 6, and 12). The top of the horizontal bracket mounts the vibrators, the relay, and some resistors. The bottom of this bracket mounts resistors, capacitors, and the wiring. The vertical bracket mounts the power transformers and associated buffer capacitors.

(4) *Back plate.* The back plate is a heavy aluminum plate which dissipates the heat conducted to it by the rear chassis, as described in (2) above, and also helps hold the rear and bottom chassis together to form a rigid assembly (fig. 6).

e. DISASSEMBLY. The front panel and the bottom chassis, described in *c* and *d* above, can be separated from the front chassis assembly. Flexible cables establish electrical connections between them (fig. 12). This arrangement permits detailed tests to be made on the power supply while all of its circuits are in operating condition.

7. Front Panel Controls, Fuses, and Connectors (fig. 7)

The following table lists the controls and other facilities on the front panel of the power supply and indicates their functions.

Control	Function
OPERATE switch (S–1).	In OFF position, de-energizes all power supply circuits by opening the battery circuit. In RECEIVE position, closes the battery circuit and energizes the receiver power supply and receiver-transmitter relay supply circuit. In the TRANS & RECEIVE position, accomplishes the same functions as in RECEIVE position and, in addition, makes power available for the transmitter power supply circuits. (Completion of the transmitter power supply circuit depends on the operation of external control circuits.)
TRANS POWER switch (S–2).	Provides for high- or low-power operation of the transmitter in the HIGH and LOW positions, respectively.
Fuses (F–1, F–2, F–3, and F–4).	Protect battery circuits from short circuits or other overloads.
Spare fuse holder	Stores spare fuses.
POWER OUT connector (J–2).	Makes power supply output voltages available for cable connection to the receiver-transmitter.
POWER IN connector (J–1).	Provides for the storage battery input connection.
Dzus fasteners	Six Dzus fasteners attach the panel and chassis assembly to the case. Two small Dzus fasteners are used to close the spare fuse holder.

8. Additional Equipment Required

Power Supplies PP–109/GR and PP–112/GR require 12- and 24-volt storage batteries, respectively, and a suitable load. Any one of the receiver-transmitters listed in paragraph 3 or the dummy load resistors shown in figure 14 constitute a suitable load.

Caution: Do not operate the power supply without a suitable load, since the high output voltages will damage the electrolytic filter capacitors and the vibrators.

9. Spare Parts Supplied

Running spares for normally expendable items such as tubes, fuses, and vibrators are provided with each power supply. These parts are listed below:

Part	Power supply	
	PP–109/GR	PP–112/GR
Fuse, cartridge, type AGU, 5 amperes	2	3
Fuse, cartridge, type AGU, 3 amperes		1
Fuse, cartridge, type AGU, 10 amperes	2	
Relay, thermal (K–1, K–2)	1	1
Resistor, thermal (R–24, R–25, R–31, R–37, R–38, R–40).	2	3
Tube type 1007, electron	1	1
Tube type OB2, electron	2	2
Tube type OA2, electron	2	2
Vibrator, 6-volt (E–1, E–2, E–3)	3	
Vibrator, 24-volt (E–1, E–2, E–3)		3

Note. This list is for general information only. See appropriate supply publications for information pertaining to requisition of new parts.

10. Difference in Models

Power Supplies PP–109/GR and PP–112/GR are very similar. They differ mainly in their input voltage requirements and in the type of vibrators used. Power Supply PP–112/GR uses 24-volt vibrators; Power Supply PP–109/GR utilizes 6-volt vibrators. The power supplies differ also in those components, for example, resistors, transformers, and capacitors, which are necessary to accommodate the different input voltages. Specific differences are discussed in paragraph 20.

CHAPTER 2

THEORY OF POWER SUPPLIES PP-109/GR AND PP-112/GR

11. Block Diagram
(fig. 8)

a. Figure 8 is a functional block diagram typical of either power supply. It shows that three h-v (high-voltage) circuits and three l-v (low-voltage) circuits are supplied from the common storage battery input terminals. The h-v circuits are vibrator supplies used to provide the plate, screen, and bias voltages for the receiver and transmitter circuits in Receiver-Transmitter RT–66/GRC, RT–67/GRC, or RT–68/GRC. The l-v circuits are used to supply the receiver-transmitter filament and relay potentials.

b. The 85-volt circuit (E–3 and T–3) is energized whenever the OPERATE switch is in either the RECEIVE or the TRANS & RECEIVE position. The 150-volt circuit (E–2 and T–2) is energized when the OPERATE switch is in the TRANS & RECEIVE position and relay O–1 is energized. To energize the transmitter h-v supply (E–1 and T–1) the OPERATE switch must be in the TRANS & RECEIVE position, relay O–1 must be energized, and TRANS POWER switch S-2 must be in the HIGH position.

c. TRANS POWER switch S–2, in addition to breaking or making the battery circuit to the transmitter h-v supply (*b* above), connects the vibrator output circuits for HIGH or LOW power operation of the receiver-transmitter.

d. The l-v circuits include: the receiver filament supply circuit with output at terminal L of J–2; the transmitter filament supply circuit with output at terminal N of J–2; and the control relay supply circuit with output at terminal A of J–2. The transmitter filament circuit is completed only when relay O–1 is energized.

e. Each of the h-v and l-v circuits is equipped with r-f noise suppression filters in both the input and output leads. Similarly, a-c ripple filters are included in the output lead of each circuit.

12. Battery Input Circuit
(fig. 17)

The 24-volt storage battery input required for the operation of Power Supply PP–112/GR is brought in on terminals B(+) and C(−) of POWER IN connector J–1. The voltage is applied over the contacts of a four-pole, three-position switch (OPERATE switch S–1) to four branch circuits, each of which is equipped with a fuse and a battery supply filter. OPERATE switch S–1 serves as the power on-off switch for the receiver and transmitter circuits operated from this power supply (pars. 13 through 18).

13. Receiver Filament Supply Circuit

The filament supply circuit for the receiver is completed from the POWER IN connector to terminal L of J–2 through section D of S–1, fuse F–1, choke L–4, resistor R–39, ballast tubes R–40 and R–31, contacts 7 and 5 of K–2, and choke L–16.

a. Battery input filter L–4 and C–5 prevents h-f (high-frequency) interference from reaching the battery circuit.

b. Ballast tubes R–40 and R–31 are essentially variable resistors, the resistances of which vary according to the voltage supplied. If the input voltage decreases, the voltage drop across the ballast tubes decreases, causing a decrease in the resistance of the tubes. This action results in a constant current through the circuit and a constant voltage available for the filament circuit.

c. The thermal relay serves as protection against excessive increases in filament voltages caused by variations in the output load. For example, if tube filaments in the receiver open, the contacts of the relay open and insert R–32 in series with the filament supply circuit and in series with the heater element of K–2. The value of this resistor is sufficiently high to drop the output voltage to a value which will not damage the tube filaments and render the receiver completely inoperative. Resistors R–33, R–34, and R–35 drop the heater element voltage to a value which will permit K–2 to open its contacts under overload conditions.

d. Capacitor C–30 removes l-f (low-frequency), a-c ripple from the d-c voltage.

e. The filter circuit consisting of choke L–16 and capacitor C–31 serves to filter h-f, a-c voltages from the d-c output.

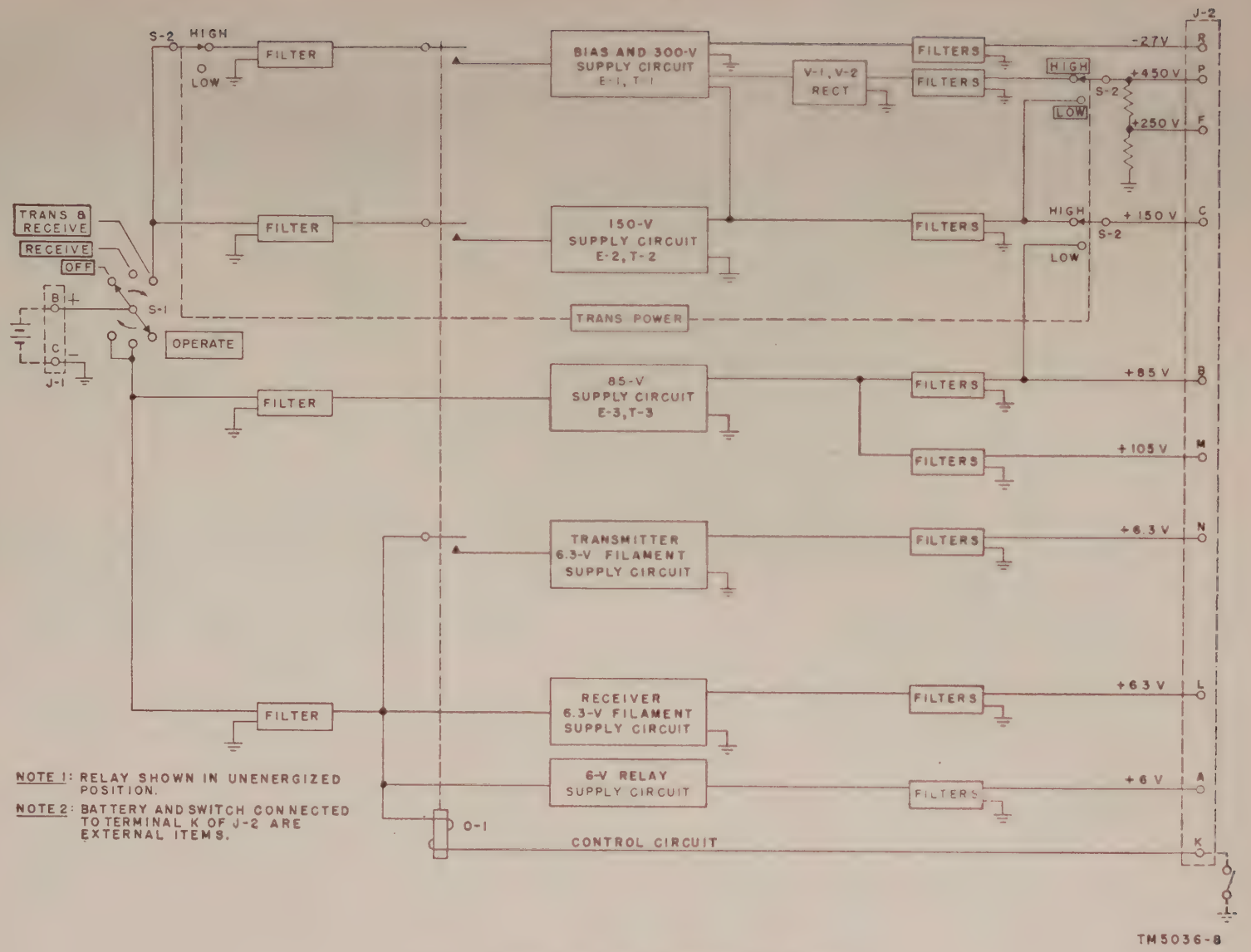


Figure 8. Typical power supply, functional block diagram.

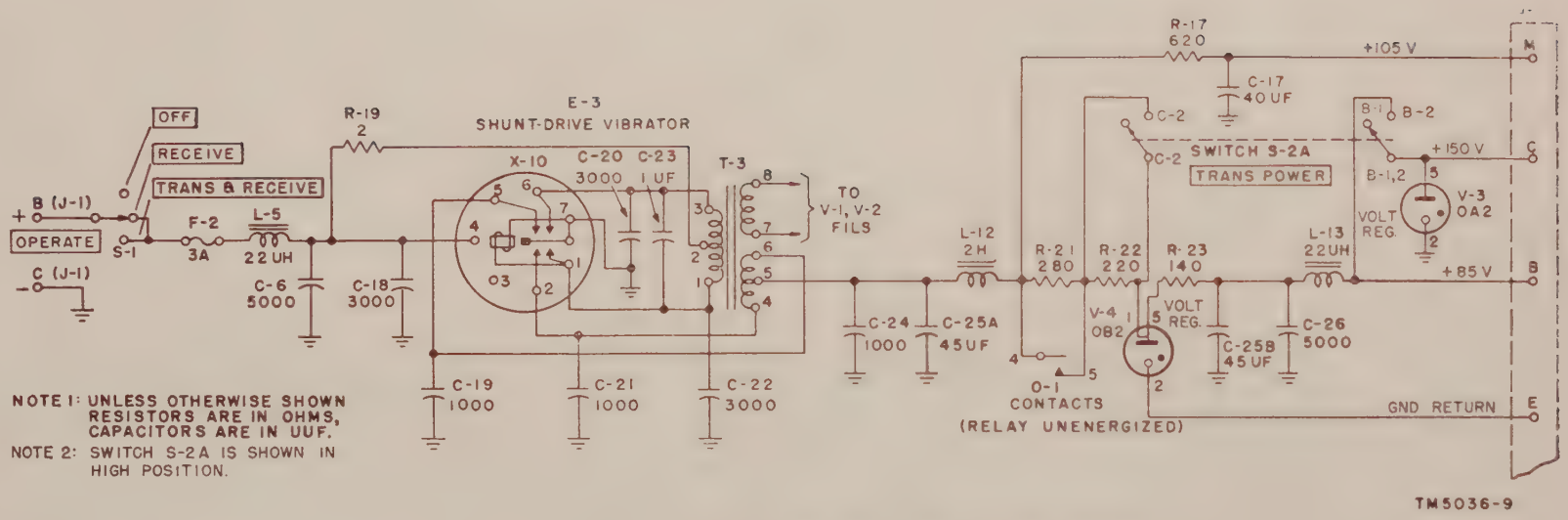


Figure 9. Power Supply PP-112/GR, 85-volt supply circuit, functional diagram.

14. Transmitter Filament Supply Circuit

The transmitter filament supply circuit also extends through section D of switch S-1, through fuse F-1, and choke L-4. It continues over the normally open contacts (3 and 2) of relay O-1 and extends through voltage-dropping resistor R-36, through series-parallel arrangement of ballast tubes R-37, R-38, R-24, and R-25 to the normally closed contacts of thermal relay K-1. The 6.3-volt output is applied through filter choke L-14 to terminal N of J-2.

a. The series-parallel arrangement of ballast tubes R-37 and R-38 and R-25 and R 24 is used to allow for the relatively large amount of transmitter filament current supplied by the circuit. Resistors R-26, R-27, and R-28 associated with thermal relay K-1 have functions comparable to those of resistors R-32, R-33, R 34, and R 35 associated with thermal relay K-2 (par. 13*c*).

b. Capacitor C-27 is an l-f a-c ripple filter.

c. Choke L-14 in combination with capacitor C-28 is a h-f noise filter.

15. Relay Supply Circuit

The relay supply circuit also extends through section D of S-1, choke L-4, and continues through voltage-dropping resistor R 30 and choke L-15 to terminal A of J-2. L-15 and C-29 form an h-f noise filter.

16. 85-Volt Supply Circuit
(fig. 9)

The 85-volt supply circuit extends over battery terminals C and B of J-1, through section C of S-1 (when in either RECEIVE or TRANS & RECEIVE position), through fuse F-2 and battery filter L-5 and C-6, to the input of the vibrator circuit proper. The vibrator circuit includes vibrator E-3 and transformer T-3. In the following subparagraphs, the discussion is based on the assumption that a shunt-drive vibrator is inserted in vibrator socket X-10. The operation of the circuit for a series-drive vibrator is described in paragraph 19.

a. Conversion to AC. Electrons flow from the ground terminal of the battery to pin 7 of X-10, through the vibrator coil to pin 1 of X-10, through one-half of the primary winding (1-2) of transformer T-3, resistor R-19, r-f filter choke L-5, fuse F-2, and the contacts of switch S-1, and to the positive terminal of the battery. Current through the driving coil develops a magnetic field which attracts the reed until it closes contact 1. In this position of the reed, the coil is taken out of the battery circuit by connecting contacts 1 and 7 to ground. The field collapses and the reed is returned by spring action to the neutral position. However, the reed inertia carries it through the neutral position and causes it to close contact 6. Battery current flows through winding 3-2 of T-3, in a direction opposite to the current which previously flowed through winding 1-2 of T-3. The reed is returned again by spring action toward the neutral position. It is accelerated through the neutral position toward contact 1 by the magnetic pull caused by the passage of current through the driving coil while the reed is in motion. The reed then closes contact 1 and again short-circuits the driving coil. The cycle is then repeated. Thus the flow of current through the driving coil is interrupted by periodic short-circuiting of the coil. As the reed vibrates, battery current flows alternately through vibrator contacts 1 and 6 connected to the primary winding. This reversal of current flow through the primary of T-3 constitutes an ac which induces a stepped-up a-c voltage in the h-v winding (4-5-6) and a stepped-down a-c voltage in the filament winding (7-8).

b. Rectification. The stepped-up a-c voltage induced in winding 4-5-6 of T-3 is rectified by contacts 2 and 5 of the vibrator. Because of the voltage induced in the secondary winding of T-3, terminals 4 and 6 are alternately made negative with respect to terminal 5 (the center tap). The vibrator reed is phased with the secondary voltage, so that vibrator contacts 2 and 5 alternately ground terminals 4 and 6 at the same time that those terminals are negative with respect to the center tap. The center tap (terminal 5) is therefore always positive with respect to chassis ground.

c. R-F Filtering. Buffer capacitor C-23 serves to reduce sparking at the vibrator contacts due to h-v transients, and it also improves the waveshape. This prevents damage to the contacts. Capacitors C-19 through C-22 serve to bypass r-f noise voltages to ground.

d. Output Circuits. The d-c output voltage is taken off at the center tap (terminal 5) of T-3. R-F noise voltages are bypassed to ground by capacitor C-24. The filter consisting of L-12 and C-25 serves to eliminate l-f a-c ripple from the d-c output voltage. At the output of the ripple filter the circuit branches off. One branch extends through ripple filter R-17 and C-17 to terminal M of connector J-2. This branch supplies 105 volts to the final receiver audio stage in the receiver-

transmitters. Another branch extends through resistors R–21, R–22, and R–23, and through r-f filter choke L–13 to terminal B of connector J–2. The filter section composed of L–13 and C–26 serves to eliminate r-f noise from the d-c output. The following arrangements are provided to maintain the output voltage constant at 85 and 105 volts against changes in load current:

(1) The normally open contacts (4 and 5) of relay O–1 short out R–21 when the relay is energized to turn on the transmitter power supply circuit.
(2) Voltage regulator tube V–4 is connected from the junction of R–22 and R–23 to terminal E of J–2 and serves to limit the maximum output voltage of the power supply when terminal E is grounded externally.
(3) A connection from terminal B of J–2 through section B of switch S–2A substitutes the output of the 85-volt vibrator circuit for the output of the 150-volt vibrator-transformer (E–2 and T–2) at terminal C of J–2 when the TRANS POWER switch is in the LOW position. V–3, which is permanently connected to terminal C, does not fire when the lower potential is applied to maintain a constant output on the 85-volt supply under the additional load condition, resistor R–22 is short circuited when S–2 is in the LOW position.

17. 150-Volt Supply Circuit
(fig. 17)

a. The 150-volt supply circuit extends from the input terminals of J–1 through section B of switch S–1 (in the TRANS & RECEIVE position), to fuse F–3 and r-f choke L–6 to vibrator-transformer circuit E–2 and T–2.

b. The operation of this circuit is similar to that described for the 85-volt circuit (par. 16). In this case, however, the vibrator circuit is completed through the normally open contacts (7 and 8) of relay O–1. When this relay is energized, vibrator E–2 functions in the same manner as described for E–3 (par. 16), and an output voltage is developed across the secondary winding of T–2. Note that terminal 5 is positive with respect to ground for the d-c output voltage. Buffer capacitor C–13 serves to suppress transformer transients. Capacitor C–12 suppresses r-f noise voltages.

c. The rectified output voltage at terminal 5 of T–2 is routed through the l-f a-c ripple filter (L–9, R–16, C–14A, and C–14B) and through the r-f noise voltage filter, L–11 and C–16, to sections A and B of TRANS POWER switch S–2A.

d. When S–2 is in the HIGH position, the circuit is completed through section B of S–2A to terminal C of J–2. In the HIGH position, V–3 serves to limit the maximum voltage appearing at terminal C to the required value. When the switch is in the LOW position, the connection through section B of S–2A is broken, V–3 is removed from the 150-volt circuit, and the output of the 150-volt supply circuit is connected through section A of S–2A to terminal P of J–2, in place of the 450-volt supply which is normally connected to the terminal. With V–3 no longer in the circuit, it is possible for the output voltage to rise above 150 volts. The LOW position of S–2 (section B) also connects the 85-volt supply to terminal C of J–2, in place of the output of the 150-volt supply circuit, E–2 and T–2.

e. A connection from terminal 5 of T–2 to terminal 5 of T–1 arranges the voltages appearing across these two transformers in series with each other and serves as a basis for deriving the 450-volt supply (par. 18).

18. 450-Volt Supply Circuit
(fig. 17)

a. D-C voltage from the storage battery is routed through section A of switch S–1 (in the TRANS & RECEIVE position), over contacts of S–2B (when in the HIGH position), through fuse F–4 and r-f noise filter L–7 and C–8 to the vibrator-transformer circuit (E–1 and T–1). The battery circuit is completed to the center tap (terminal 2) of T–1 through contacts 9 and 10 of relay O–1 when the relay is energized.

b. The process of converting the d-c voltage to an a-c voltage across the secondary windings of transformer T–1 is the same as that described in paragraph 16. The a-c voltage is developed across the 300-volt secondary winding (4–5–6) of T–1 and across the 27-volt winding (7–8–9) of T–1.

c. The voltage appearing across winding 7–8–9 is rectified by contacts 2 and 5 of vibrator E–1 in the manner similar to that described in paragraph 16. The vibrator reed is phased with the secondary voltage so that vibrator contacts 2 and 5 ground terminals 9 and 7 of T–1, alternately, at the same time that those terminals are positive with respect to the center tap. The center tap (terminal 8) is therefore always negative with respect to chassis

ground. The output is taken off at terminal 8 of that winding, routed through ripple filter R–6 and C–3 and r-f filter L–2 and C–4 and applied as a negative bias potential to terminal R of J–2.

d. The a-c voltage developed across winding 4–5–6 of T–1 is rectified by a circuit consisting of two twin diode tubes, V–1 and V–2, type 1007 gas-filled full-wave rectifiers. The h-v winding of T–1 is connected to one plate in V–1 and to one plate in V–2. The remaining plates are bridged from one tube to the other by resistors R–4 and R–5. These resistors permit conduction through each tube at all times. The center tap of the winding is raised approximately 150 volts above ground by its connection to the center tap of the secondary winding of T–2. The filament supply for V–1 and V–2 is obtained from winding 8–7 of transformer T–3. The rectified output of V–1 and V–2 is taken from the filaments and is filtered by the network consisting of r-f noise voltage filter L–1, L–8, and C–11 and the a-c ripple filter L–3, C–9A, C–9B, C–10A, and C–10B. Resistors R–7, R–8, R–9, and R–10 are bleeder resistors which insure an equal division of voltages across capacitors C–9 and C–10.

e. With switch S–2 in the HIGH position and relay O–1 energized, the 450-volt output voltage is applied through section A of S–2A to voltage divider R–12 and R–11. A 450-volt potential is then available at terminal P of J–2. The voltage divider provides a 250-volt potential at terminal F. With switch S–2 in the LOW position, the 450-volt output circuit is disconnected from P of J–2. The input circuit is broken by the switch (S–2B) on the rear wafer of S–2. When either of these conditions exists, the power circuit is not energized and no output voltage exists. However, since the filaments are energized from secondary winding 7–8 of T–3, which is always in operation whenever switch S–1 is on (par. 16), the filaments remain lit as long as E–3 is operative.

19. Operation of Power Supply PP–112/GR with Series-Drive Vibrators

The operation of Power Supply PP–112/GR using series-drive vibrators in the 85-, 150-, and 450-volt supply circuits is generally the same as described in paragraphs 16, 17, and 18, respectively. In the series-drive vibrators, however, a separate contact is connected in series with the driving coil to periodically interrupt the battery circuit through the coil.

a. 85-Volt Supply Circuit. The battery circuit extends from pin C of J–1 to pin 7 of X–10 through the series arrangement of the vibrator reed and the additional driving contact, through the driving coil connected to pin 4 of X–10, and through filter choke L–5, fuse F–2, and contacts of switch S–1 in either the RECEIVE or TRANS & RECEIVE positions back to terminal B of J–1.

b. 150-Volt Supply Circuit. When a series-drive vibrator is used in this circuit, the circuit similarly extends from pin 7 of X–8, through the series arrangement of the vibrator reed and the additional driving contact, through the driving coil connected to pin 4 of X–8, and through filter choke L–6 and fuse F–3 and over the contacts of switch S–1 in the TRANS & RECEIVE position to terminal B of J–1. Only the load circuit of the vibrator is completed through contacts of relay O–1.

c. 450-Volt Supply Circuit. The circuit arrangement for the 450-volt supply circuit when a series-drive vibrator is used is the same as described in *a* and *b* above, except that the circuit to terminal B of J–1 extends through choke coil L–7, fuse F–4, contacts of switch S–2 in the HIGH position, and contacts of switch S–1 in the TRANS & RECEIVE position. Only the load circuit of the vibrator is completed through contacts of relay O–1.

20. Power Supply PP–109/GR (fig. 18)

a. Power Supply PP–109/GR is very similar to Power Supply PP–112/GR, but is designed for use with a 12-volt storage battery. Since 6-volt vibrators are used, however, voltage-dropping resistors R–18, R–20, R–13, R–14, R–1, and R–2 are used to drop the driving voltage to 6 volts. Resistors R–20, R–14, and R–2 are effective when shunt-drive vibrators are used in the 85-, 150-, and 450-volt supply circuits, respectively. Resistors R–18, R–13, and R–1 are in the circuit when series-drive vibrators are used in the corresponding supply circuits.

b. In the case of the 6-volt shunt- or series-drive vibrator, the battery circuits for the 85-, 150-, and 450-volt supply circuits are very similar to those described for Power Supply PP–112/GR when using a corresponding vibrator.

c. The values of current-limiting resistors R–19, R–15, and R–3 differ from those of the corresponding parts in Power Supply PP–112/GR. In Power Supply PP–109/GR, buffer capacitors C–23, C–13, and C–2 are shunted across the secondary windings of transformers T–3, T–2, and T–1, respectively. The reason for this is that the values of capacitance which would be needed across the primary winding to accomplish the same purpose would be imprac-

ticable. These capacitors are dual units arranged in series to provide the proper voltage rating.

d. The filament supply circuit for the receiver is completed from the POWER IN connector to terminal L of J–2 through section D of S–1, fuse F–1, choke L–4, ballast tube R–31, contacts 7 and 5 of K–2, and choke L–16.

(1) Battery input filter L–4 and C–5 prevents h-f interference from reaching the battery circuit.

(2) Ballast tube R–31 will compensate for variations of the input source by changing resistance as the voltage varies and thereby regulating the amount of filament current.

(3) The function of the thermal relay is described in paragraph 13*c*. Note that voltage-dropping resistors R–33, R–34, and R–35 are placed in the circuit so that there is a greater voltage drop across the heater element of the thermal relay in Power Supply PP–109/GR than in Power Supply PP–112/GR. The higher voltage is necessary because of the tendency of the relay to open and close too readily when operated from the lower voltage supply.

e. The transmitter filament supply circuit extends through contacts D of switch S–1, through fuse F–1, and choke L–4. It continues over the normally open contacts (3 and 2) of relay O–1 and extends through parallel ballast tubes R–24 and R–25 to the normally closed contacts of thermal relay K–1. The 6.3-volt output is applied through filter choke L–14 to terminal N of J–2.

(1) Capacitor C–27 is an l-f a-c ripple filter.

(2) Choke L–14 in combination with capacitor C–28 is an h-f noise filter.

(3) The parallel arrangement of ballast tubes R–24 and R–25 is used to allow for the relatively large amount of transmitter filament current supplied by the circuit. Resistors R–26, R–27, and R–28 have functions comparable to those of resistors R–32, R–33, R–34, and R–35 associated with thermal relay K–2.

f. The value of resistor R–30 in the relay supply circuit differs from that of the corresponding part in Power Supply PP–112/GR.

CHAPTER 3

FIELD MAINTENANCE INSTRUCTIONS

Section I. PREREPAIR PROCEDURES

Note. This chapter contains information for field maintenance. The amount of repair that can be performed by units having field maintenance responsibility is limited only by the tools and test equipment available, and by the skill of the repairman.

21. Tools and Cleaning Equipment

Tools and cleaning materials needed for repairing and cleaning the power supplies are contained in Tool Equipment TE–113.

22. Test Equipment

The following equipment is required for making the tests described in this chapter:

1 Storage battery (24- or 12-volt for Power Supply PP–112/GR or PP–109/GR, respectively).
1 Voltohmmeter, such as Electronic Multimeter TS–505/U or equal.
1 D-C ammeter (ranges 0 to 10 and 0 to 20 amperes), Multimeter TS–352/U.
1 Vacuum-tube voltmeter, Electronic Multimeter ME–6/U or equal.
1 Voltammeter I–50.
10 Load resistors, wire wound, ±5% tolerance. For values see figure 14.
1 Tube Tester I–177.
1 Fuse, 20 amperes, 25–30 volts.
1 Fuse, 15 amperes, 25–30 volts.
1 Capacitor, paper, 2 uf ±10%, 600 vdcw.
1 Resistor, composition, 5,000 ohms ±10%, 1 watt.
1 Test Lead Set CX–1331/U.
1 On-off switch.

Caution: Do not operate the power supply without the suitable loads. The output voltage of the power supply when operated without output loads is considerably higher than normal, because of the inherent regulation of the unit.

23. Removal of Pluck-Out Parts
(figs. 3 through 6, 10, and 11)

a. Fuses. All fuses in the power supply are accessible from the front panel. Unscrew the fuse caps at the top of the front panel. Removal of the caps will also cause the fuses to come out of their holders, since the caps are also fuse extractors.

b. Removing Immersionproof Cover. Before access may be had to the other pluck-out parts, the immersionproof cover must be removed. Loosen the Dzus fasteners around the edges of the front panel. Stand the unit on the front panel and lift off the cover. Be careful not to damage any wiring or components while removing the cover. Place the panel-and-chassis assembly on a flat surface so that the front panel hangs over the edge and the bottom chassis rests on the surface. This precaution is necessary to prevent damage to switches and wiring.

c. Removing Heat Barriers. Heat barriers, consisting of flexible sheets of heat-insulating material, have been inserted in various locations in the units to protect wire insulation from high heat sources. This material usually must be removed when the unit is being disassembled, but must be replaced on reassembly. It is extremely important for the operating life of the equipment that these barriers be in place at all times.

d. Removing Vibrators. The three vibrators used in the power supply (E–1, E–2, and E–3) are located on the bottom chassis (fig. 5). Pull the vibrators from their sockets. Do not rock or jiggle the vibrator in its socket, since this may spread the vibrator socket contacts and damage the vibrator. Use a straight upward pull. If necessary, the vibrator may be pried out of the socket by means of a screw driver. In doing so, be careful not to damage the socket, spread the vibrator-retaining spring clip, or break the rubber seal at the base of the vibrator. Once the vibrator is freed from its socket it can be removed by tilting it toward the side of the unit.

e. Removing Electrolytic Capacitors.

(1) The two large plug-in type electrolytic capacitors, C–27 and C–30, are held in place by spring clips on a bracket attached to the right side of the front chassis assem-

bly (fig. 5). Remove the screws which hold the bracket and spring-clip assembly in place. Save the screws and associated washers; they will be needed for reassembly purposes. Lift off the bracket and spring-clip assembly. Remove the electrolytic capacitors by a straight pull (lateral or upward, depending on the position of the power supply unit). Do not rock or jiggle the capacitors in their sockets; the capacitor or socket prongs may be damaged.

(2) Remove electrolytic capacitors C–3, C–9, C–10, C–14, and C–25 from the top front chassis (fig. 3). Observe the precautions noted above.

Note. Electrolytic capacitor **C–17** is not a plug-in part.

f. Removing Rectifier Tubes, Ballast Tubes, Thermal Relays, and Voltage Regulator Tubes. These parts are located on the rear chassis, at the top of the unit (figs. 3 and 4). While removing these parts, be careful not to damage socket contacts or the prongs on the part.

24. Disassembly for Inspection and Cleaning (figs. 10, 11, and 12)

a. General. Save all screws and washers removed during the following disassembly procedure; they will be needed for reassembly of the unit. Place the screws in their original holes; this will keep them from being lost and will serve as a reminder as to where they belong.

Caution: Once the front panel has been loosened, be careful not to pull on the wires or to otherwise damage any of the exposed parts or wiring. Do not pull on the panel while the chassis is being disassembled or moved about.

b. Panel. Place the unit, less case and pluck-out parts, on the edge of a flat surface, so that the

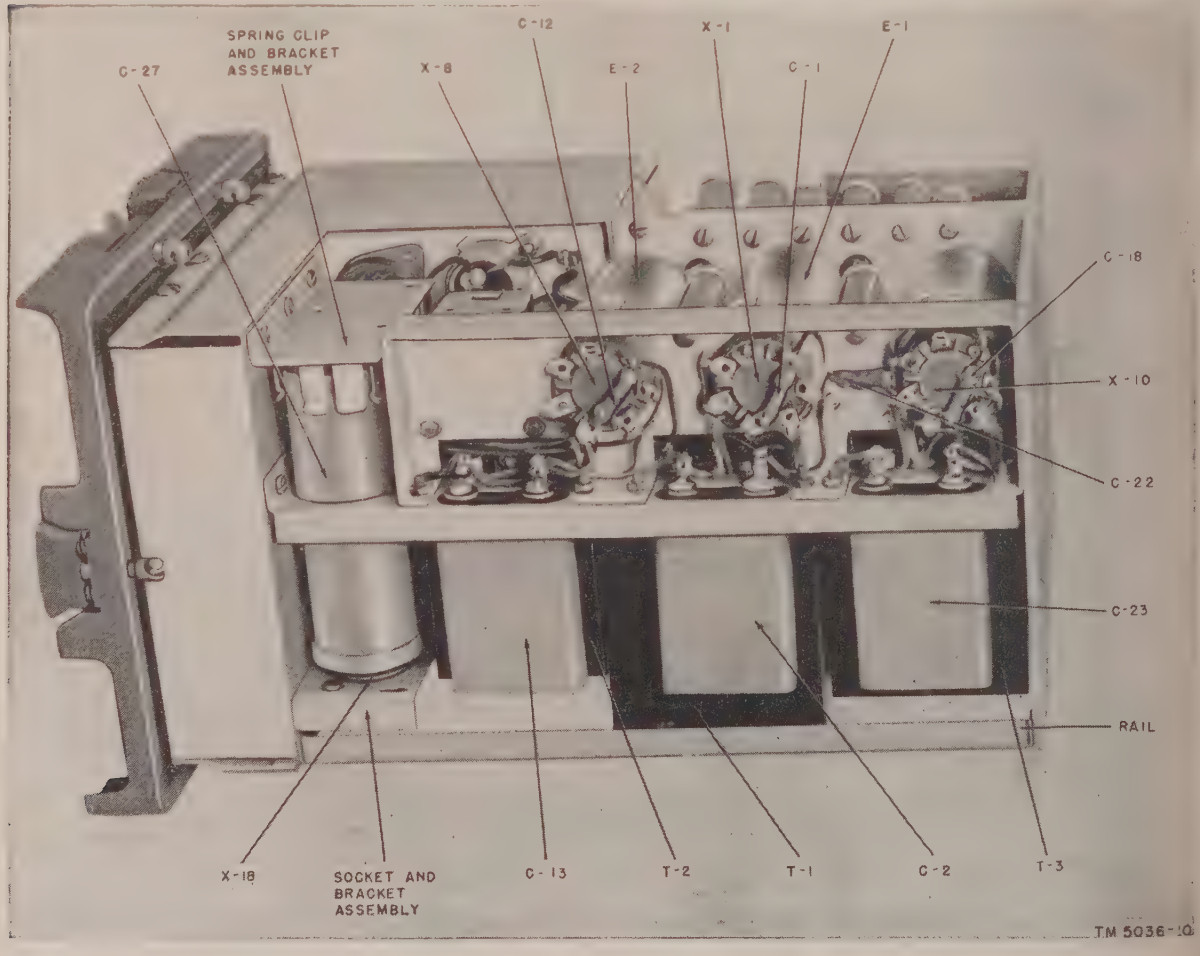


Figure 10. Power Supply PP–112/GR, bottom view.

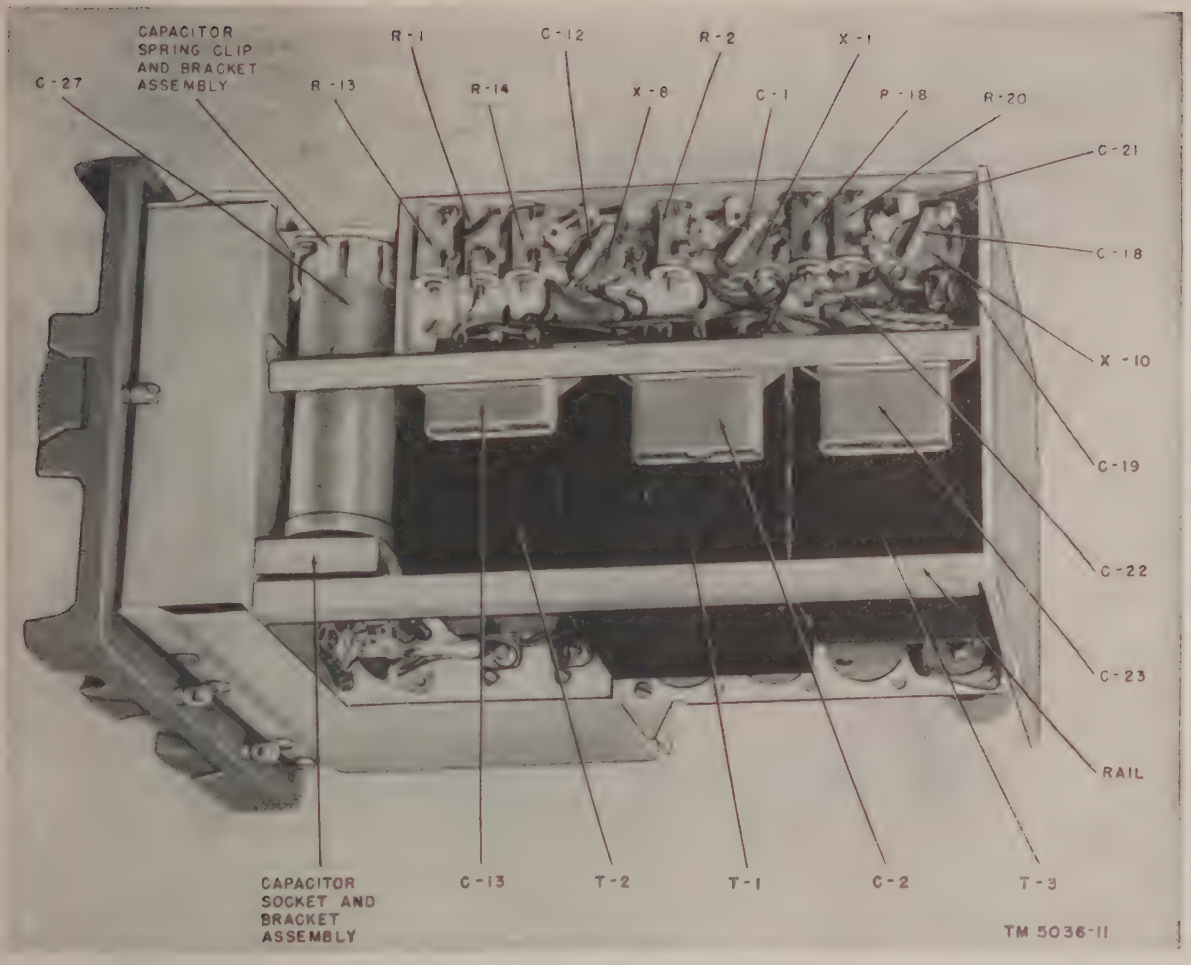


Figure 11. Power Supply PP-109/GR, bottom view.

front panel hangs over the edge of the surface and the bottom chassis rests on the surface. Proceed as follows:

(1) Remove the eight screws and shakeproof washers which hold the panel to the main chassis assembly.
(2) Carefully pull the panel away from the chassis as far as the cable wiring will permit. Do not loosen any of the soldered connections. Do not place undue strain on the cable. Handle switch assemblies only when necessary.
(3) Rest the panel on the surface; do not strain the cable wires.

c. Bottom Chassis. To disengage the bottom chassis, proceed as follows:

(1) Turn the unit upside down. Facing the rear of the power supply unit, remove the screws at each end of the rail in the upper left-hand corner of the unit, and remove the rail (fig. 11).
(2) Place the unit on its side, so that the vibrator shelf is uppermost, the rear plate to the right, and the front panel to the left (fig. 10).
(3) Remove the three hexagonal-head screws which fasten the transformer and buffer capacitor mounting bracket to the front of the assembly.
(4) Remove the five flat-head screws which hold the bottom chassis to the rear plate.
(5) The bottom chassis assembly can now be disengaged from the upper chassis and rear plate assembly. Pull the bottom chassis away from the rest of the unit. Do not loosen any soldered connections or place undue strain on the two connecting cables.

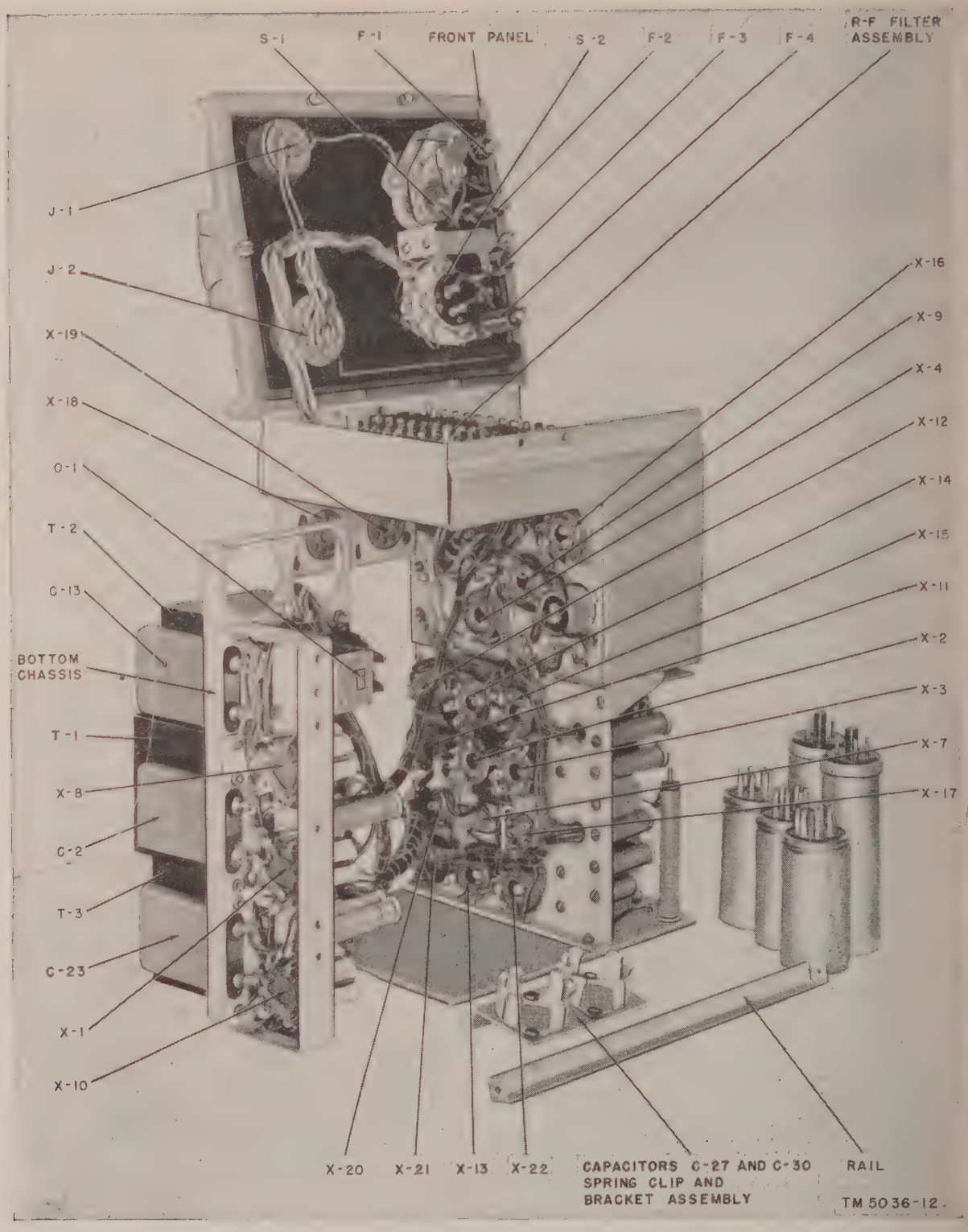


Figure 12. Power Supply PP–112/GR, disassembled view.

d. Upper Chassis Assembly. After the disassembly procedure described in *b* above has been accomplished, the upper chassis assembly can be moved away from the bottom chassis. Rotate the assembly to expose the wiring on the socket terminals (fig. 12).

25. Visual Inspection

After the unit has been disassembled (pars. 23 and 24), it is possible to inspect all parts and wiring. Inspect the unit thoroughly for any abnormal conditions. If any are found, the cause of such conditions should be determined and the defects remedied before proceeding with trouble shooting and other tests (pars. 28 through 34). Repair instructions are given in paragraphs 35 through 38.

a. Chassis. Examine the chassis for bent or broken plates, defective welds or rivets, dirt, corrosion, or other defects.

b. Wiring. Examine for loose, defective, or broken wiring. Look for charring, loose connections, breaks in the insulation, or other evidence of damage. Examine especially the lugs on capacitor, vibrator, and tube sockets, transformers, chokes, switches, and connectors.

c. Mounting Hardware. Examine all nuts, bolts, and other mounting hardware on the chassis to make sure that they are not loose. Loose mounting hardware may cause intermittent noises in the set which is operated from the power supply.

d. Sockets. Inspect tube, vibrator, and electrolytic capacitor sockets for broken or excessively spread contacts. Examine the contacts for evidence of corrosion and accumulation of dirt or grease. Check socket mounting hardward to determine that the sockets are secured firmly to the chassis. Check the condition of all wiring to the sockets.

e. Plugs and Connectors. Examine plugs and connectors for improper contact tension, loose mounting hardware, or corrosion. Check wiring to the connectors for improper connection, breaks, or damage to insulation.

f. Capacitors. Examine capacitors for signs of discoloration, leaks, bulges, dirt, loose mounting, or loose connections. Check for swelling or leaky electrolytic capacitors. Melted or oozing wax or other dielectric is a sign of damage to the part. Such capacitors should be removed for an electrical check and replaced with good ones. Metal encased capacitors should be cleaned and the mounting hardware should be tightened.

g. Resistors. Examine resistors for blistering, discoloration, or other signs of overheating. Inspect leads and all other connections for corrosion, dirt, dust, looseness, or broken or trailing strands in the connecting wires. Discoloration of a resistor usually indicates that the component has been overheated or operated under overload; this indicates a defect in another component. (Power resistors may discolor due to the heating of the fungicidal lacquer; this does not indicate a defective resistor.) Do not attempt to remove resistors that have pigtail connections. These connections may break at the point of entry into the body of the resistor and thus make the resistor useless.

h. Transformers and Chokes. Leakage of potting compound from chokes and transformers usually indicates a short-circuited or overloaded coil winding and possibly a defective resistor or capacitor.

i. Relay. Examine the relay for defective, dirty, and broken contacts. Check contact tension and note whether relay contacts are properly made. Check for broken connecting leads.

j. Fuse Holders. Check fuse holders and fuse caps for signs of burning, charring, or corrosion, and for poor contact with the fuse.

Note. A burned-out fuse is usually a sign of failure in another part of the circuit. When a fuse in one of the four main circuit branches is found to be burned out, the trouble is automatically localized to that particular branch, that is, the 1-v filament and relay supplies, the 85-volt supply, the 150-volt supply, or the 450-volt supply.

k. Spring Clips. Check for tension and breakage.

l. Switches. Operate the switches on the front panel to each of their operating positions, to determine that they work easily with no searching for contacts. Examine switch contacts for evidences of corrosion, improper contact, or dirt.

26. Cleaning

a. Dirt or corrosion will interfere with electrical continuity and mechanical efficiency of the parts of the unit by causing circuits to be shorted or insulated, or by causing switches to be jammed. For these reasons, it is important to clean all parts of the chassis and panel carefully and thoroughly.

b. Cleaning means the removal of particles of dust, grease, rust, corrosion, moisture, wax, or soot. No set method can be given for removal of dirt because of the many ways and places in which it can collect. Cleaning should be done with a lintless cloth, fine (#000) sandpaper, crocus cloth, or a

soft brush. In more difficult cases, carefully clean the affected parts with the sharp edge of a screw driver. Dust and grease can usually be removed with a cloth or brush moistened in solvent, dry-cleaning (SD). Never use gasoline for cleaning. Use extra care in cleaning spots which are difficult to reach or parts which are delicate, in order to avoid damage to wiring or parts. Where it is necessary to remove portions of the moistureproof-fungiproof coating to clean a part properly, refinishing is essential. Refinishing information is given in paragraph 42.

c. Use an air hose if available to blow out dust and lint from the chassis. Make sure, however, that no oil or water is carried along with the air stream, and that the air stream is controlled so that damage to small resistors and capacitors does not result.

d. Clean cases of all capacitors, contact pins on electrolytic capacitors, and dirty or corroded connections. In most cases a dry cloth will do the job. If deposits of dirt are hard to remove, moisten the cloth with solvent (SD).

e. Clean resistors with a small brush. Resistors with discolored bodies cannot be cleaned.

f. Clean dirty or corroded socket and switch contacts. Clean vibrator and capacitor spring clips. Use fine sandpaper or crocus cloth to remove corrosion, oxidation, or dirt.

g. Use a relay burnisher to clean pitted or corroded contacts on the relay. Use carbon tetrachloride to remove all dirt and dust particles from the contacts. Wipe moisture with a dry, clean, lintless cloth. While cleaning the relay, be careful not to damage or distort the contacts.

27. Inspecting and Cleaning Pluck-Out Parts

a. Inspect the vibrator shells for discoloration caused by overheating, and inspect the bases for dirty or loose pins. If the vibrator is in bad condition, check as described in paragraph 28*a*. If defective, discard it and substitute a new vibrator known to be in good condition. Inspect the electrolytic capacitors for discoloration, corrosion, or bulging. If any of these conditions are observed, test as described in paragraph 28*b*. If defective, substitute a new electrolytic capacitor known to be in good condition. Clean the base pins of the vibrators and electrolytic capacitors by rubbing them lightly with fine crocus cloth. Dust with a small clean brush. Clean the base, shell, and pins with a clean lint-free cloth moistened with solvent (SD). Dry in air draft.

Note. The vibrators are hermetically sealed into their shells; they should never be opened.

b. Inspect glass and metal envelopes of tubes, thermal relays, ballast tubes, and voltage regulators for accumulation of dirt and corrosion. Replace any of these items which have loose envelopes. Inspect the bases and pins of these items for evidence of damage. Clean dirty and corroded pins, using fine sandpaper to remove corrosion, oxidation, and dirt. Wipe off moisture with a clean, dry cloth.

c. Clean fuse ends and clips with fine sandpaper. Wipe with a clean cloth. Throw away all blown fuses.

28. Testing Pluck-Out Parts

The tests for the pluck-out parts (*a* through *g* below) require the use of an ohmmeter. These tests are continuity checks and they do not test the part for actual performance. Substitution of the part in a set known to be operating properly is a more reliable test procedure. However, this test should not be attempted if continuity checks indicate a faulty part. For rectifier tubes, ballast tubes, and voltage regulators, use a suitable tube checker to test the part for proper functioning.

a. Vibrators. Using an ohmmeter, test each vibrator for normal electrical continuity, as shown in the chart below:

Pins	24-volt vibrator (Power Supply PP-112/GR)		6-volt vibrator (Power Supply PP-109/GR)	
	Series-drive (ohms)	Shunt-drive (ohms)	Series-drive (ohms)	Shunt-drive (ohms)
4 and 7	480 to 540	Infinity	12	Infinity.
3 and 7	Infinity	Infinity	Infinity	40.
1 and 7	Infinity	480 to 540	Infinity	Infinity.
2 and 7	Infinity	Infinity	Infinity	Infinity.
5 and 7	Infinity	Infinity	Infinity	Infinity.
6 and 7	Infinity	Infinity	Infinity	Infinity.

b. Electrolytic Capacitors. Before making any measurements or repeating a measurement, discharge the capacitor by shorting the positive and negative terminals.

(1) The plug-in electrolytic capacitors may be tested by using an ohmmeter. For testing the capacitors which have a h-v rating (C–9, C–10, C–14, and C–25), use the high-resistance scale (at least 5 megohms) of the ohmmeter. For the l-v capacitors

(C–3, C–27, and C–30), use the 50,000-ohm range of the ohmmeter. Test each section of dual electrolytic capacitors separately.

(2) Connect the positive lead of the ohmmeter to the positive terminal of the capacitor. Connect the negative lead of the meter to the negative terminal of the capacitor. The ohmmeter first should indicate a very low value of resistance. The pointer then should move toward the high-resistance readings on the scale.

(3) The final resistance reading should be about 1 megohm for h-v capacitors C–9, C–10, C–14, and C–25 and about 15,000 ohms for each section of l-v capacitors C–3, C–27, and C–30.

(4) If the final reading for either section of the h-v capacitors is less than 250,000 ohms, the part probably is defective and should be replaced. If the final resistance reading for any l-v capacitor is less than 15,000 ohms, the capacitor is faulty and should be replaced. The measurement data is summarized in the following chart:

Circuit symbol	Capacity (uf)	Voltage rating (volts)	Ohmmeter range	Terminal connection		Normal reading (ohms)
				Positive	Negative	
C–9, C–10, C–14:						
Section A	35	350	5 megohms	3	1	250,000
Section B	35	350	5 megohms	5	1	250,000
C–25:						
Section A	45	300	5 megohms	3	1	250,000
Section B	45	300	5 megohms	5	1	250,000
C–3	500	50	50,000 ohms	5	1	15,000
C–27, C–30	2,000	15	50,000 ohms	5	1	15,000

c. Thermal Relays (K–1 and K–2). Use an ohmmeter to check continuity as follows:

Pins	*Meter reading (ohms)*
5 and 7	0
2 and 3	28

d. Ballast Tubes. An ohmmeter connected between pins 2 and 7 of the ballast tube should show a continuity reading. The actual resistance is very small and depends on the current through the tube.

e. Voltage Regulator Tubes. Use an ohmmeter to make the measurements indicated as follows:

Pins	*Reading*
1 and 5	continuity
2 and 4	continuity
2 and 7	continuity
2 and 5	open

Note. An emission check can be obtained by means of a tube checker.

f. Rectifier Tubes. Using a tube checker (such as Tube Tester I–177) capable of measuring the type 1007 rectifier tubes, check tubes V–1 and V–2. Otherwise, use an ohmmeter to make the following continuity checks:

Pins	*Reading*
1 and shell	continuity
7 and 8	continuity
3 and 7	infinity
5 and 7	infinity

g. Fuses. Use an ohmmeter to check the fuses for continuity.

29. Reassembly

The arrangement of Power Supplies PP–109/GR and PP–112/GR is such that even though the units are disassembled as described in the preceding paragraphs, electrical continuity exists between all parts of the unit. Because of the complexity of the mechanical arrangement, the unit should be left unassembled for the tests and repairs which are described in the following sections. The trouble-shooting procedures (sec. II) and the repair procedures (sec. III) are based on the assumption that the units are in a disassembled condition. Do not reassemble the unit until the required results are obtained after making the checks (pars. 31 and 32) and necessary repairs. The reassembly procedure is given in paragraph 37.

Caution: When power is applied to the unit in a disassembled condition, very high voltages exist at various points in the circuit. Be extremely careful to avoid touching any exposed part, since the voltages are high enough to cause severe injury or death.

Section II. FIELD TROUBLE SHOOTING

Warning: *a.* When servicing Power Supply PP–109/GR or PP–112/GR, be extremely careful because of the high voltages exposed. Always turn the OPERATE switch, S–1, to the OFF position before making resistance measurements or before touching parts or wiring in the unit with the fingers. Even with the power source disconnected from the unit, potentials as high as 600 volts may still be present across capacitors, particularly the electrolytic capacitors. Before touching any part or repairing the unit when the voltage is shut off, short the part to ground. When making voltage measurements on exposed parts or terminals, use heavily insulated test probes. Keep one hand in pocket.

b. Never connect the battery to the power supply unless suitable output loads are connected across each pair of output terminals (fig. 14).

30. Trouble-Shooting Procedures

The test procedures for locating trouble in the power supply are outlined in the following steps:

a. Short-Circuit Checks. Resistance measurements are made to locate short circuits which may damage the battery or the equipment when power is applied (par. 31).

b. Operational Checks. Measurements of the input voltage, the battery current drain in the input circuit, and the voltage delivered in the output circuits are made as a rapid check of the operating conditions of the power supply (par. 32).

c. Resistance Measurements. These tests are made to locate faults or defective components and wiring (par. 33).

d. Voltage Measurements. Voltage measurements (par. 34) at significant points of the circuit may disclose faults not observable during previous tests.

31. Short-Circuit Checks

Restoré good fuses into the proper fuse holders on the panel, replace the fuse caps, and using Electronic Multimeter TS–505/U, make the resistance measurements listed in the following subparagraphs. To make these measurements, it is assumed that the other pluck-out parts are not in their sockets, that the unit has not yet been reassembled, and that all external cables have been disconnected. Use an ohmmeter range suitable for the particular resistance reading to be obtained.

a. Make the measurements indicated in figure 13. The readings at POWER IN connector J–1 should be taken for all three positions of OPERATE switch S–1. The readings at POWER OUT connector J–2 should be taken for both positions of TRANS POWER switch S–2, in each case with relay O–1 operated manually. The readings shown in figure 13 should be obtained.

b. Make the measurements indicated in the following table. All measurements are made to ground.

Terminal	On part	Typical reading (ohms)	Test conditions
F	J–2	22,500	S–2 in LOW position.
P	J–2	31,500	S–2 in LOW position.
F	J–2	18,650	S–2 in HIGH position.
P	J–2	24,000	S–2 in HIGH position.
8	T–1	Infinity	S–2 in HIGH position.
5	T–1	Infinity	S–2 in HIGH position.
7	T–3	24,000	S–2 in HIGH position.
5	T–3	Infinity	S–2 in HIGH position.

c. Do not apply power to the unit until the tests of *a* and *b* above have been made and until the indicated readings are obtained. Incorrect readings may indicate a shorted or leaky capacitor, or a wire or a lug shorted to the chassis. Check each capacitor in the affected circuit section for leakage or a short, and replace if necessary. Check wires and lugs on component parts, particularly on switches. Repair if necessary. Refer to the schematic diagrams of figures 17 and 18.

32. Operational Tests and Procedures

a. The purpose of the operational checks described in this paragraph is to determine whether the power supply delivers the proper output voltages and draws the required amount of current from the storage battery when loads simulating actual operating conditions are connected across the output terminals. The tests are made for the various conditions under which the unit may be operated, namely, for each position of switch S–2 and for the RECEIVE or TRANS & RECEIVE position of switch S–1. Based upon the results of these measurements, the trouble in the power supplies

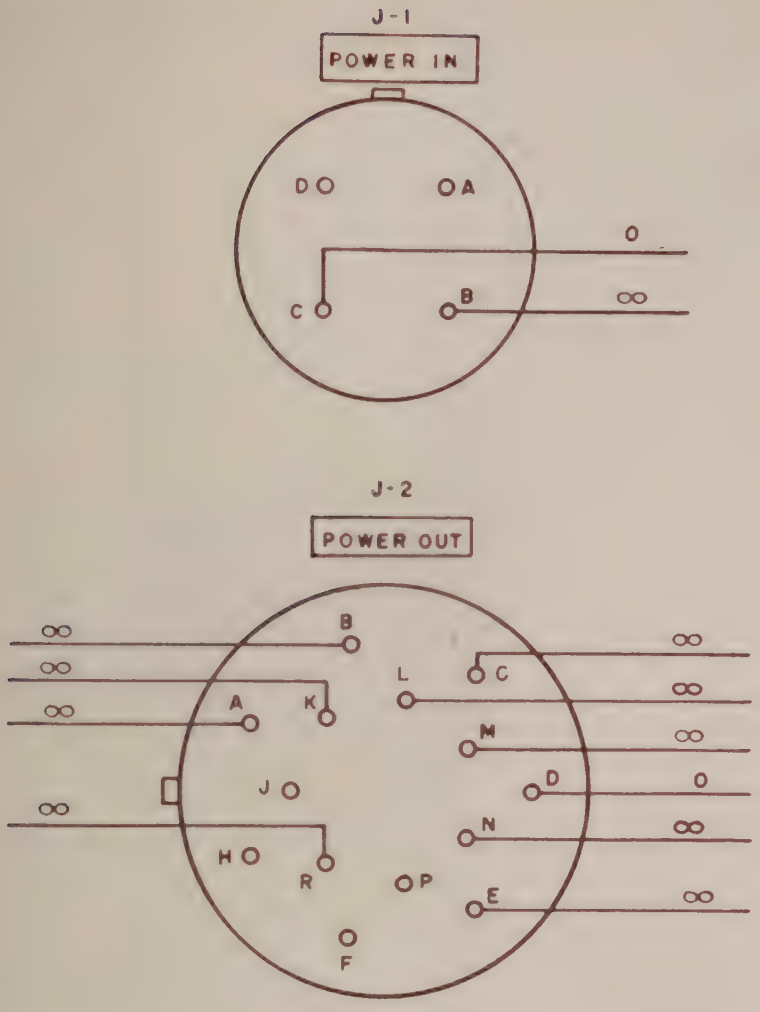


Figure 13. Short-circuit tests at connectors J–1 and J–2.

may be sectionalized directly to one of the circuit sections. Refer to the detailed checks outlined in paragraphs 33 and 34 to trace the fault to a specific part within the particular circuit section.

b. Refer to the operational test set-up shown in figure 14 and proceed as follows, using the test equipment listed in paragraph 22. Insert all plug-in parts.

(1) Select a storage battery having the required voltage (12 and 24 volts for Power Supplies PP–109/GR and PP–112/GR, respectively). Turn switch S–1 to OFF position.

(2) Connect the negative battery lead to pin C of connector J–1.

(3) Connect the positive battery lead in series with the fuse and the ammeter to pin B of J–1. The rating of the fuse, the ammeter scale, and the battery voltage to be used should be as listed below. (Use Multimeter TS–352/U, Voltammeter I–50, or an ammeter with equivalent ranges.)

Power supply	Nominal battery voltage	Fuse (F) rating (amperes)	M–1 meter range (volts)	M–2 meter range (amperes)
PP–109/GR	12.6	20	0–20	0–20
PP–112/GR	25.2	15	0–50	0–15

(4) Connect a strap between terminals E and D of J–2.

(5) Connect an SPST switch between K and D of J–2.

(6) Connect a load resistor between terminal D and each of the other terminals of J–2, as indicated in figure 14. Be sure that correct load resistors are connected for the particular condition of operation. A properly loaded and alined Receiver-Transmitter RT–66/GRC, RT–67/GRC, or RT–68/GRC may be used in place of the load resistors.

(7) Turn switch S–1 to the RECEIVE position and turn switch S–2 to the HIGH position. Using Electronic Multimeter TS–505/U, measure the input and output voltages across each of the load resistors as indicated by meters M–1 and M–3 in figure 14. Also note the ammeter reading. The required readings are shown in the following tables. For this check, keep the switch between terminals K and D of J–2 open.

Power supply	M–1 input (volts)		M–2 input (amperes)	
	Minimum	Maximum	Minimum	Maximum
PP–109/GR	12.4	12.8	2.05	2.55
PP–112/GR	24.8	25.6	1.40	1.60

Power Supplies PP–109/GR and PP–112/GR

Terminals on J–2	M–3 output (volts)	
	Minimum	Maximum
A	5.2	6.0
B	78	92
C		
F		
L	5.9	6.7
M	96	114
N		
P		
R		

(8) Turn switch S–1 to the TRANS & RECEIVE position and turn switch S–2 to the HIGH position. Close the switch between terminals K and D of J–2. Measure the input current and the input and output voltages across each of the load resistors. The required readings are shown in the following tables:

Power supply	M–1 input (volts)		M–2 input (amperes)	
	Minimum	Maximum	Minimum	Maximum
PP–109/GR	12.4	12.8	10.5	13.2
PP–112/GR	24.8	25.6	6.3	8.0

Power Supplies PP–109/GR and PP–112/GR

Terminals on J–2	M–3 output (volts)	
	Minimum	Maximum
A	5.2	6.0
B	78	92
C	138	161
F	215	285
L	5.9	6.7
M	90	100
N	5.9	6.7
P	415	485
R	−23	−31

(9) Leave switch S–1 in the TRANS & RECEIVE position and set switch S–2 in the LOW position. Close the switch between

terminals K and D of J-2. The correct readings are shown in the following tables:

Power supply	M-1 input (volts)		M-2 input (amperes)	
	Minimum	Maximum	Minimum	Maximum
PP-109/GR	12.4	12.8	5.7	7.1
PP-112/GR	24.8	25.6	3.9	4.9

Power Supplies PP-109/GR and PP-112/GR

Terminals on J-2	M-3 output (volts)	
	Minimum	Maximum
A	5.2	6.0
B	75	105
C	75	105
F	90	130
L	5.9	6.7
M	75	105
N	5.9	6.7
P	170	230
R	0	0

c. When the required readings are obtained, proceed with the additional tests given in paragraph 39. If the required readings are not obtained, proceed with the detailed trouble localization checks given in paragraphs 33 and 34.

33. Resistance Measurements

These checks are intended to locate the defective components or wiring responsible for the failure to meet the requirements of paragraph 32. For these checks disconnect the battery and all external connections from connector J-2. Use Electronic Multimeter TS-505/U or an equivalent meter. The points to be tested, the required readings, and the probable cause of trouble, if the readings are incorrect, are listed in the following table. Replace any component found to be defective. When connecting test leads across electrolytic capacitors, observe the correct polarity. Replace any components removed during tests after such checks are completed.

Note. If no test conditions are given in the test condition column in the following subparagraphs, the switch setting and relay conditions are immaterial.

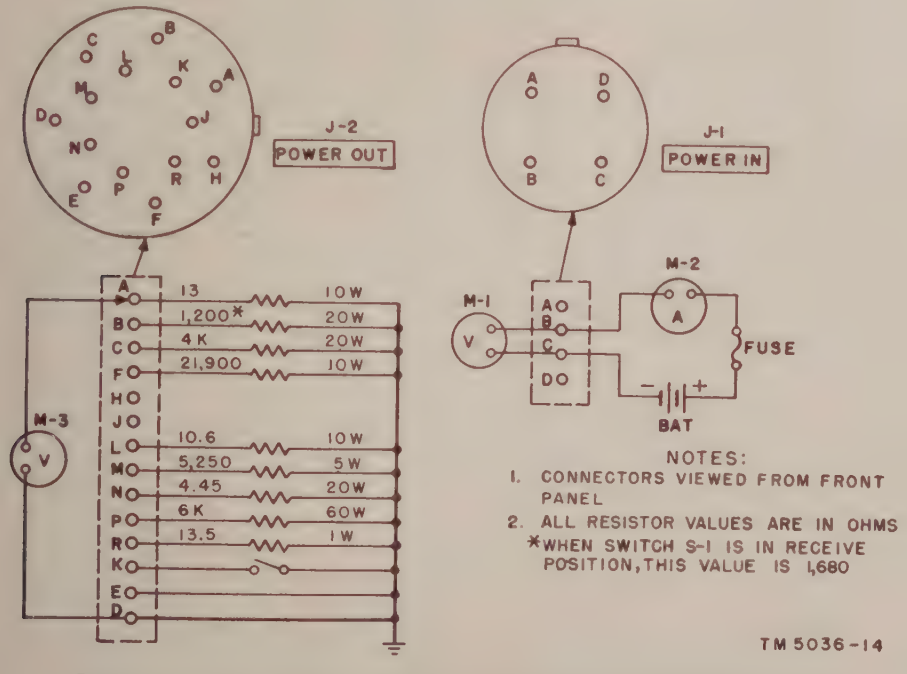


Figure 14. Power Supplies PP-109/GR and PP-112/GR, operational test set-up.

a. RECEIVER FILAMENT SUPPLY CIRCUIT. If incorrect or no output voltage is measured at terminal L of J–2, make the following measurements. In Power Supply PP–112/GR, remove R–31, K–2, and R–40 from their sockets.

Point of measurement	Test condition	Normal reading (ohms)		Probable trouble
		PP–109/GR	PP–112/GR	
Term B on J–1 to term 2 on R–40 (or R–31) socket.	S–1 on RECEIVE	0	9	Defective S–1, F–1, L–4, or R–39 in Power Supply PP–112/GR only.
Term 7 on R–40 to term 2 on R–31 socket.			0	Defective wire.
Term 7 on R–31 socket to term L on J–2.	K–2 plugged in	16	16	Defective R–32 or L–16.
		0	0	Defective K–2, or wiring.
Term L on J–2 to term D on J–2.		Infinity	Infinity	Defective wiring, C–30, or C–31.
Term L on J–2 to term D on J–2.	K–2 plugged in	32	32	Defective K–2, R–33, R–34, R–35, or wiring.

b. TRANSMITTER FILAMENT SUPPLY CIRCUIT. If incorrect or no output voltage is measured at terminal N of J–2, make the following measurements. For these measurements, remove thermal relay K–1 from its sockets.

Point of measurement	Test condition	Normal reading (ohms)		Probable trouble
		PP–109/GR	PP–112/GR	
Term N on J–2 to term 5 on K–1 socket.		0	0	Defective L–14.
Term N on J–2 to term D on J–2.		Infinity	Infinity	Defective C–27 or C–28.
Term N on J–2 to term D on J–2.	K–1, in socket, ballast tubes removed.	32	32	Defective C–27, or C–28, or wiring.
Term 5 on K–1 socket to term 7 on K–1.		16	16	Defective R–26.
Term B on J–1 to term 7 on K–1 socket.	Relay O–1 manually operated. Ballast tubes in sockets. S–1 on RECEIVE.	1	5	Defective S–1, F–1, L–4, or ballast tube socket wiring, or R–36 in PP–112/GR only.
Term B on J–1 to term 7 on K–1.	Ballast tubes in sockets. O–1 open. R–31 removed. S–1 on RECEIVE.	Infinity	Infinity	Shorted contacts of O–1.

c. RELAY CIRCUIT. If relay O–1 fails to operate when terminal K of J–2 is grounded, or operates when terminal K of J–2 is not grounded externally (i.e., if incorrect voltages are measured at terminals N, C, F, P, and R of J–2), make the following measurements:

Point of measurement	Test condition	Normal reading (ohm)		Probable trouble
		PP–109/GR	PP–112/GR	
Term B on J–1 to term K on J–2.	S–1 on RECEIVE	63	?85	Defective S–1, F–1, L–4, coil of O–1, L–10.

d. Relay Supply Circuit. If incorrect or no output voltage is measured at terminal A of J–2, make the following measurements:

Point of measurement	Test condition	Normal reading (ohms)		Probable trouble
		PP–109/GR	PP–112/GR	
Term A on J–2 to term B of J–1.	S–1 on RECEIVE	16	45	Defective L–15, R–30, L–4, F–1, or S–1.
Term A on J–1 to term B of J–1.	S–1 on TRANS & RECEIVE	16	45	Defective S–1.

e. 85-Volt Supply Circuit. Make the following measurements if incorrect or no output voltage is measured at terminal B or M of J–2. For these measurements, remove vibrator E–3 from its socket.

Point of measurement	Test condition	Normal reading (ohms)		Probable trouble
		PP–109/GR	PP–112/GR	
Term B to C on J–1	S–1 on RECEIVE. R–31 removed.	Infinity	Infinity	Defective C–6 or C–18, C–20 or C–22.
Term B on J–1 to term 1 on X–10	S–1 on RECEIVE	(*)	2.7	Defective S–1, F–2, L–5, R–19, or T–3.
Term B on J–1 to term 6 on X–10.	S–1 on TRANS & RECEIVE	(*)	2.7	Defective S–1 or wiring on S–1.
Term B on J–1 to term 4 on X–10.	S–1 on TRANS & RECEIVE	(*)	2.7	Defective T–3.
Term B on J–1 to term 3 on X–10.		20	0	Defective wiring or R–18 in PP–109/GR only.
Term B on J–2 to term 5 on X–17.		51	Infinity	Defective wiring or R–20 in PP–109/GR only.
Term 5 on X–17 to term 5 on T–3.	S–2 on HIGH. O–1 not operated.	140	140	Defective L–13 or R–23.
Term 5 on X–17 to term 5 on T–3.	S–2 on LOW. O–1 manually operated.	660	660	Defective L–12, R–21, R–22, S–2, O–1 contacts, or T–3.
Term 5 to 2 on X–10		160	160	Defective O–1, S–2 contacts, or L–12.
Term 7 to 8 on V–1 or V–2	V–1 and V–2 out of sockets	45	45	Defective T–3.
Term M on J–2 to term 5 on T–3.		(*)	(*)	Defective T–3.
Term E on J–2 to term 2 on X–17.		780	780	Defective R–17 or L–12.
Term 2 on X–10 to term 1 on L–12.		0	0	Defective wire.
Term 7 on X–10 to chassis		23	23	Defective T–3 or wiring.
		0	0	Open ground connection.

* Less than 1 ohm.

f. 150-Volt Supply Circuit. Make the following measurements if the voltage readings at terminal C of J–2 are found to be incorrect. For these measurements, set switch S–1 in the TRANS & RECEIVE position and remove vibrator E–2 from its socket. Set switch S–2 and operate relay O–1 manually as directed in the test condition column.

Point of measurement	Test condition	Normal reading (ohms)		Probable trouble
		PP–109/GR	PP–112/GR	
Term B on J–1 to term 4 on X–8.		20	0	Defective S–1, F–3, L–6, or R–13 in PP–109/GR.
Term B on J–1 to term 2 on T–2.	O–1 unoperated	Infinity	Infinity	Defective contacts of O–1.
Term B on J–1 to term 2 on T–2.	O–1 manually operated	(*)	2	Defective contacts 7–8 of O–1 or R–15.
Term B on J–1 to term 1 on X–8.	O–1 manually operated	(*)	3	Defective T–2.
Term B on J–1 to term 6 on X–8.	O–1 manually operated	0.75	3	Defective T–2.
Term 6 to term 3 on X–8		51	Infinity	Defective T–2 or R–14 in PP–109/GR.
Term 7 on X–8 to chassis		0	0	Open ground connection.
Term 5 on X–8 to term 2 on X–8.		125	110	Defective T–2, or in PP–109/GR, C–13.
Term C on J–2 to term 5 on X–7 (V–3).		0	0	Defective wiring.
Term 2 on X–7 to chassis		0	0	Defective ground connection.
Term 2 on X–8 to term 3 on X–3 (V–2).		135	135	Defective T–2, T–1, or wiring.
Term C on J–2 to term 5 on T–2.	S–2 in HIGH position	660	660	Defective S–2, L–11, R–16, or L–9.
Term C to B on J–2	S–2 in HIGH position	Infinity	Infinity	Defective S–2 or wiring.
Term C to B on J–2	S–2 in LOW position	0	0	Defective S–2 or wiring.
Term 5 on T–2 to term 5 on T–1.		0	0	Defective wiring between T–1 and T–2.

g. 450-VOLT SUPPLY CIRCUIT. Make the following measurements if incorrect voltage readings are obtained at terminal R, P, or F of J–2. For these measurements, remove vibrator E–1 from its socket, and set switch S–1 to the TRANS & RECEIVE position. Operate switch S–2 and relay O–1 manually as directed in the test condition column.

Point of measurement	Test condition	Normal reading (ohms)		Probable trouble
		PP–109/GR	PP–112/GR	
Term B on J–1 to term 4 on X–1.	S–2 on HIGH	20	0	Defective S–1, F–4, L–7, or R–1.
Term B on J–1 to term 4 on X–1.	S–2 on LOW	Infinity	Infinity	Defective S–2.
Term B on J–1 to term 1 on X–1.	S–2 on HIGH. O–1 unoperated.	Infinity	Infinity	Defective O–1 contacts 9–10.
Term B on J–1 to term 1 on X–1.	S–2 on HIGH. O–1 manually operated.	(*)	3	Defective O–1 contacts, R–3, or T–1.
Term B on J–1 to term 6 on X–1.	S–2 on HIGH. O–1 manually operated.	(*)	3	Defective T–1.
Term 6 to 3 on X–1		51	Infinity	Defective T–1 or R–2 in PP–109/GR.
Term 7 on X–1 to chassis		0	0	Open ground connection.
Term 5 to 2 on X–1		12	12	Defective winding 7–8–9 of T–1.
Term R on J–2 to term 5 on X–1.		500	500	Defective L–2 or R–6.

* Less than 1 ohm.

Point of measurement	Test condition	Normal reading (ohms)		Probable trouble
		PP-109/GR	PP-112/GR	
Term 5 on X-2 to term 3 on X-3.		150	160	Defective winding 4-5-6 of T-1.
Term 3 on X-2 to term 3 on X-3.		1 megohm	1 megohm	Defective R-4.
Term 5 on X-2 to term 5 on X-3.		1 megohm	1 megohm	Defective R-5.
Term 5 on T-1 to term 5 on T-2.		0	0	Open wire.
Term 7 to 8 on X-2	V-1 and V-2 out of sockets	(*)	(*)	Defective winding 7-8 of T-3.
Term 7 to 8 on X-3	V-1 and V-2 out of sockets	(*)	(*)	Defective wiring.
Term P to D on J-2	S-2 on LOW	31,500	31,500	Defective S-2, R-12, or R-11.
Term P to D on J-2	S-2 on HIGH	24,000	24,000	Defective S-2, L-8, L-3, R-7 through R-10, C-9, C-10, or C-11.
Term P on J-2 to term 5 on T-2.	S-2 on HIGH	Infinity	Infinity	Defective S-2.
Term P on J-2 to term 5 on T-2.	S-2 on LOW	660	660	Defective S-2, L-11, R-16, or L-9.
Term P on J-2 to term 7 on X-2.	S-2 on HIGH	160	160	Defective L-1, L-3, L-8, or S-2.
Term F to term D on J-2	S-2 on LOW	22,500	22,500	Defective R-11.
Term 1 on X-3 to chassis		0	0	Open ground connection.
Term 1 on X-2 (V-1) to chassis.		0	0	Open ground connection.

* Less than 1 ohm.

34. Voltage Measurements

The voltage checks in this paragraph supplement the resistance measurements of paragraph 33 and are intended to find defects which are not readily determined by resistance measurements, that is, defective capacitors or partially shorted windings. For these measurements, reinsert all plug-in parts. Connect storage battery (+) to pin B on J-1 and storage battery (−) to pin C on J-1. Connect the load resistors, switch, and ground connection as described in paragraph 32. Refer to the schematics in figures 17 and 18 to identify the points measured with the component involved. Use Electronic Multimeter TS-505/U or an equivalent meter. The following table lists measurements at significant points in the circuits of the power supplies. All measurements are made to ground with TRANS POWER switch in the HIGH position and relay O-1 operated, and they apply to both power supplies.

Caution: High voltages are present at some of the measuring points.

Point of measurement	Normal reading (volts)	Probable trouble
Term 8 on T-1	−28	Defective T-1, shorted C-3, C-4.
Term 5 on T-1	175	Defective T-1, shorted C-14, C-9.
Term 5 on T-3	135	Defective T-3, shorted C-17, C-24, C-25, L-12.
Term 7 on T-3	467	Defective L-1, L-3, C-9, or C-10, or defective wiring.
Term 2 on L-9	170	L-9, R-16 grounded.
Term 2 on L-12	115	L-12 grounded, defective wiring.
Term 5 on V-4	95	Defective wiring, R-23 grounded.
Term 3 on K-2	5	Defective R-33, R-34, R-35.
Term 3 on K-1	5.4	Defective R-27, R-28.
Term 7 on R-40	12.6	Defective R-31, R-39, R-40.
Term 7 on R-38	12.6	Defective R-37, R-38, R-24, R-25 (and R-36 in PP-112/GR).

35. Replacement of Parts

When replacing parts in Power Supplies PP–109/GR and PP–112/GR, observe the precautions given below.

a. Tagging Leads. Tagging leads is essential to assure that correct rewiring will be made when a part is replaced. Before unsoldering any leads, tie together the leads that are attached to each part. Use small tags or short pieces of adhesive tape to identify all wires in accordance with their numbered connections. Identify every lead that is to be removed.

b. Parts and Substitutions. When damaged parts must be replaced, identical parts should be used. If identical parts are not available and the damaged component is beyond repair, a substitution must be made. The part substituted must have identical electrical properties and must be of equal or higher voltage and current rating.

c. Location. Relocation of substituted parts may cause hum and is not recommended.

d. Mounting. Mount the new or replaced part in the same mounting as that formerly occupied by the damaged part. Fasten all mountings securely.

e. Soldering. Before soldering any connections, carefully scrape all parts that will be touched by the solder, until all traces of rust, corrosion, paint, or varnish are removed. Remove the scraped parts with a small, clean brush. Tin all surfaces to be soldered. Wrap the wire around the lug to obtain mechanical support. Use a small amount of solder to make the connection and use sufficient heat to make the solder flow evenly around the tinned surfaces.

f. Retropicalization. If the parts to be replaced require special treatment, such as retropicalization, follow the instructions given in the appropriate publication referred to in section V of this chapter.

36. Special Repair Procedures

Most of the parts in these power supplies are readily accessible and can be easily replaced without special instructions. Special repair procedures required for repairing or replacing sockets, r-f chokes, panel connectors, switch S–1, relay O–1, and the transformers are given in that order in the following subparagraphs.

a. Sockets. All sockets are attached to the chassis by means of rivets. To change a socket:

(1) Remove the part plugged into the socket.
(2) Unsolder the wires connected to the socket.
(3) Drill out the two rivets which fasten the socket to the chassis.
(4) Substitute a new socket and fasten it with rivets or machine screws, lockwashers, and nuts.
(5) Resolder the wires to the socket.
(6) Clean the unit thoroughly to remove solder drops and metal chips.
(7) Check the new connections with those shown in the schematic for that unit.

b. R-F Chokes. All r-f chokes, except choke L–1, are located in the recess of the lower portion of the front chassis and bracket assembly behind the front panel (fig. 12). To gain access to the chokes, proceed as follows.

Note. The r-f chokes are made of heavy wire and are not easily damaged. Do not attempt the following procedures unless it is absolutely certain that an r-f choke or C–11 is defective.

(1) Separate the panel from the chassis assembly (par. 24).
(2) Remove the eight screws which fasten the terminal board to the filter assembly.
(3) Carefully unsolder all ground leads from the capacitors to the metal strip.
(4) Remove all connections to the front panel cable from the terminal board.
(5) Remove the metal ground strip by removing the mounting screws.
(6) Carefully tilt the terminal board back toward the top of the unit. This exposes the r-f chokes and C–11.
(7) Remove the screw which fastens the defective choke to the terminal board.
(8) Unsolder the wires from the choke to the terminals on the terminal board.
(9) Remove the choke and repair or replace if necessary.
(10) Reassemble the choke on the axial screw and tighten the nut.
(11) Remount the terminal board and resolder the wires, being careful not to damage the wires or to short them to the chassis.

c. Panel Connectors. To remove panel connectors, it is necessary to use a spanner wrench or long-nose pliers.

(1) Insert the teeth on the spanner wrench into the notches in the rim of the connector on the front panel.
(2) Turn the spanner wrench in the counterclockwise direction until the rim is removed. Remove the lockwasher.
(3) Remove the connector from the rear of the panel.
(4) Unsolder all wires.
(5) Resolder the wires to the new connector. Make sure that the new part has a rubber gasket.
(6) Clean thoroughly to remove solder drops.
(7) Check the new connections with those shown in the schematic for that unit.
(8) Reinsert the connector from the rear of the panel.
(9) Reinsert the lockwasher and rim and, using the spanner wrench, screw the rim back on to the connector. Check the assembly for tightness.

d. Switch S–1. To replace switch S–1, it is necessary to separate the panel from the chassis assembly.

(1) Unsolder all wires from the top deck of the switch.
(2) Remove the two nuts which fasten the top deck of the switch to the remainder of the switch assembly.
(3) Lift off the top deck.
(4) Unsolder all wires from lower deck.
(5) Remove the castellated nut on the front of the panel.
(6) Replace the switch by reversing the above procedure, being careful to aline the red dot on the upper deck of the switch with the red dot on the lower deck. Make sure that the locating lug goes into the hole provided for it on the front panel.
(7) When resoldering the connections, be careful to remove solder drops and to check all connections with those shown in the schematic for that unit.

e. Relay O 1. Relay O–1 is mounted on the bottom chassis by means of four screws (fig. 12).

(1) Use a relay spring bender to aline the relay contacts, so that when the armature (visible through the slot in the relay) is moved in the direction of the contacts, each of the four contact pairs closes.
(2) Use a contact burnisher to clean contacts thoroughly.
(3) Wipe off with a clean lintless cloth.
(4) Use a relay spring bender to straighten out all bent or warped contact springs.
(5) If the relay is damaged beyond repair and replacement is necessary, remove the four screws which mount the relay to the bottom chassis, lift the relay off the chassis, and disconnect all wires from it.
(6) Reconnect all wires before mounting relay O–1. Use a 12-volt relay for Power Supply PP–109/GR or a 24-volt relay for Power Supply PP–112/GR.
(7) Make sure that the contacts on the new relay are properly alined and closed when the armature is pushed in the direction of the contacts.
(8) Attach the relay to the bottom chassis, using the four screws and washers.

f. Transformers. The transformers are mounted on the vertical bracket attached to the bottom chassis. To replace these parts—

(1) Remove the vibrators.
(2) Remove the six screws and lockwashers which fasten the transformer bracket to the bottom chassis. Separate the transformers from the bottom chassis, being careful not to damage connecting wires.
(3) Disconnect all wires from the part.
(4) Remove the four nuts and washers and remove the part from the rear of the transformer bracket.
(5) When remounting the new transformer, make sure that the soldering terminals clear the chassis.
(6) Fasten with the lockwashers and nuts.
(7) Resolder all wires and check the connections against the schematic for that unit.
(8) Reassemble the transformer bracket to the bottom chassis, using the six screws and lockwashers.

37. Reassembly
(figs. 5, 6, 10, or 11, and 12)

After the inspection and tests and repairs have been made, the unit is ready for reassembly. To reassemble the unit, reverse the procedure described in paragraph 24. Proceed as follows:

a. Bring the bottom and top chassis assemblies close together, and line them up so that the bottom

chassis can be pushed into place. Make sure that the flexible cables are back in their original positions, and that wires are not pinched, stretched, or damaged during reassembly.

b. Replace and tighten the screws and lockwashers which hold the bottom chassis to the top chassis assembly.

c. Insert electrolytic capacitors C–27 and C–30. These capacitors fit through the chassis. Reattach the capacitor spring clip assembly.

d. Reattach the rail.

e. Replace the vibrators, arranging them correctly in their sockets.

f. Replace the front panel, being careful not to damage wiring. Tuck the cable carefully in place and tighten the eight mounting screws.

g. Check that all plug-in parts are firmly seated in their sockets.

h. Replace the outer case. Tighten the Dzus fasteners.

Section IV. FINAL TESTING

38. General

If the unit does not meet the requirements of paragraph 32, repeat the trouble-shooting procedures given in paragraphs 31, 33, and 34 to locate other faults. Make the necessary repairs. If the unit operates as required in paragraph 32, perform the test outlined in paragraph 39.

39. A-C Ripple Voltage Measurements

a. Connect the equipment as indicated in section II of this chapter, with the following exceptions:

(1) Substitute an a-c voltmeter (Electronic Multimeter ME–6/U or equivalent meter) for M–3, and connect it in series with a 2-uf (microfarad), 600 vdcw capacitor across each of the load resistors in turn.

(2) Connect a 5,000-ohm resistor across the meter terminals.

(3) Set switch S–1 to the TRANS & RECEIVE position and set switch S–2 to the HIGH position. Close the external switch connected between terminals K and D.

b. With the a-c voltmeter on a suitable range, check that the readings at output terminals B, C, F, M, P, and R are less than .5 percent of the nominal output voltage. If a higher reading is indicated, it is probable that the electrolytic filter capacitors or chokes in the circuit section measured need replacement. Note paragraph 40. Refer to the schematic diagram (fig. 17 or 18) to identify the electrolytic filter capacitors.

40. Output Voltage Variations

Normal changes in battery voltage and changes in output loads will affect the output voltage of the power supply. Hence, output voltage variations up to 10 percent will not necessarily indicate a faulty condition.

Section V. LUBRICATION AND WEATHERPROOFING

41. Lubrication

The power supplies described in this manual do not require lubrication. Never apply oil or grease to any parts of these units.

42. Weatherproofing and Rustproofing

a. General. Signal Corps equipment, when operated under severe climatic conditions such as prevail in tropical, arctic, and desert regions, requires special treatment and maintenance. Fungus growth, insects, dust, corrosion, salt spray, excessive moisture, and extreme temperatures are harmful to most materials.

b. Tropical Maintenance. A special moistureproofing and fungiproofing treatment has been devised which, if properly applied, provides a reasonable degree of protection. This treatment is explained in TB SIG 13 and TB SIG 72.

c. Winter Maintenance. Special precautions necessary to prevent poor performance or total operational failure of equipment in extremely low temperatures are explained in TB SIG 66.

d. Desert Maintenance. Special precautions necessary to prevent equipment failure in areas subject to extremely high temperatures, low humidity, and excessive sand and dust are explained in TB SIG 75

e. Rustproofing. Rust and corrosion can be prevented by touching up bared surfaces. Clean where necessary with fine sandpaper. Never use steel wool.

Note. For further information on general preventive maintenance techniques, refer to TB SIG 178.

CHAPTER 4

SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE

43. Repacking for Shipment or Limited Storage

Wrap and pack securely according to directions given in JAN–P–100, or as directed by commanding officer.

44. Demolition of Matériel to Prevent Enemy Use

The demolition procedures outlined below will be used to prevent the enemy from using or salvaging this equipment. Demolition of the equipment will be accomplished only upon order of the commander.

a. SMASH. Smash capacitors, transformers, resistors, sockets, terminal board, plugs, and vibrators, using sledges, axes, handaxes, pickaxes, hammers, crowbars, or heavy tools.

b. CUT. Cut wiring, using axes, handaxes, or machetes.

c. BURN. Burn technical literature, resistors, capacitors, transformers, and vibrators, using gasoline, kerosene, oil, flame throwers, and incendiary grenades.

d. BEND. Bend chassis, panels, and covers.

e. EXPLOSIVES. If explosives are necessary, use firearms, grenades, or TNT.

f. DISPOSAL. Bury or scatter the destroyed parts in slit trenches, fox holes, or other holes, or throw them into streams.

g. DESTROY EVERYTHING.

APPENDIX I

REFERENCES

Note. For availability of items listed, check SR 310–20–3 and SR 310–20–4.

1. Army Regulations

AR 380–5	Safeguarding Military Information.

2. Supply Publications

SIG 1	Introduction and Index.
SIG 5	Stock List of All Items.
SIG 7 & 8	Organizational Maintenance Allowances and Field and Base Maintenance Stockage Guide.
SB 11–47	Preparation and Submission of Requisitions for Signal Corps Supplies.
SB 11–76	Signal Corps Kit and Materials for Moisture- and Fungi-Resistant Treatment.

3. Preserving

TB SIG 13	Moistureproofing and Fungiproofing Signal Corps Equipment.

4. Packaging and Packing Instructions

JAN–D–169	Desiccants, Activated.
JAN–P–100	General Specifications.
JAN–P–106A	Boxes, Wood, Nailed.
JAN–P–116	Preservation, Methods of.
JAN–P–125	Barrier Material, Waterproof, Flexible.
JAN–P–131	Barrier-Material, Moisture-Vaporproof, Flexible.

5. Other Publications

FM 24–18	Field Radio Techniques.
SR 310–20–3	Index of Training Publications (Field Manuals, Training Circulars, Firing Tables and Charts, Army Training Programs, Mobilization Training Programs, Graphic Training Aids, Joint Army-Navy-Air Force Publications, and Combined Communications Board Publications).
SR 310–20–4	Index of Technical Manuals, Technical Regulations, Technical Bulletins, Supply Bulletins, Lubrication Orders, Modification Work Orders, Tables of Organization and Equipment, Reduction Tables, Tables of Allowances, Tables of Organization, and Tables of Equipment.
TB SIG 66	Winter Maintenance of Signal Equipment.
TB SIG 72	Tropical Maintenance of Ground Signal Equipment.
TB SIG 75	Desert Maintenance of Ground Signal Equipment.
TB SIG 123	Preventive Maintenance Practices for Ground Signal Equipment.
TB SIG 178	Preventive Maintenance Guide for Radio Communication Equipment.
TM 1–455	Electrical Fundamentals.
TM 9–2857	Storage Batteries Lead-Acid Type.
TM 11–430	Batteries for Signal Communication. Except those pertaining to Aircraft.
TM 11–453	Shop Work.
TM 11–455	Radio Fundamentals.
TM 11–483	Suppression of Radio Noises.
TM 11–486	Electrical Communication Systems Engineering.
TM 11–4000	Trouble Shooting and Repair of Radio Equipment.
TM 38–650	Basic Maintenance Manual.

6. Abbreviations

ac	alternating current
C	centigrade
dc	direct current
F	Fahrenheit
hf	high frequency
h-v	high-voltage
l-f	low-frequency
l-v	low-voltage
ma	milliampere
rf	radio frequency
uf, uuf	microfarad, micromicrofarad

APPENDIX II

IDENTIFICATION TABLE OF PARTS

Note: The fact that a part is listed in this table is not sufficient basis for requisitioning the item. Requisitions must cite an authorized basis, such as T/O&E, TA, T/BA, SIG 7–8–10, SIG 7&8, SIG 10, list of allowances of expendable material, or another authorized supply basis. The Department of the Army Supply Catalogs applicable to the equipment covered in this manual are SIG 7&8 PP 109 GR and SIG 7&8-PP 112/GR. For an index of available supply catalogs in the Signal portion of the Department of the Army Supply Catalog, see the latest issue of SIG 1, Introduction and Index.

1. Identification Table of Parts for Power Supply PP–109/GR

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
	POWER SUPPLY PP–109/GR: vibrator and electronic type; sync; outputs 6.3 v DC, 595 ma, 6.3 v, 1415 ma, 5.6 v DC, 431 ma, −27 v DC, 2 ma, 85 v DC, 71 ma, 105 v DC, 20 ma, 150 v DC, 37.5 ma, 250 v DC, 11.5 ma, 450 v DC, 75 ma; input 12.6 v DC; 12 amp.		3H4497–109
(Order through AGO channels)	TECHNICAL MANUAL (TM 11–5036).		
C–19, C–21, C–24.	CAPACITOR, fixed: mica; 1000 uuf ±10%; 500 vdcw; JAN type CM25B102K.	R–F hash filters	3K2510221
C–1, C–12, C–18, C–20, C–22.	CAPACITOR, fixed: ceramic; 3000 uuf ±20%; 500 vdcw.	R–F hash filters	3DA3–137
C–11	CAPACITOR, fixed: paper; 3000 uuf ±20%; 1000 vdcw; JAN type CP28A1EG302M.	R–F hash filters	3DA3–138
C–4 through C–8, C–15, C–16, C–26, C–28, C–29, C–31.	CAPACITOR, fixed: ceramic; 5000 uuf ±20%; 500 vdcw.	R–F hash filters	3DA5–215
C–13	CAPACITOR, fixed: paper; 2 sect; 20,000 uuf +20% −10% ea sect; 1000 vdcw ea sect; JAN type CP69B4EG203V.	Buffer, secondary, T–2	3DA20–234
C–2, C–23	CAPACITOR, fixed: paper; 2 sect; 50,000 uuf +20% −10% ea sect; 1000 vdcw ea sect; JAN type CP69B4EG503V.	C–2: Buffer, secondary, T–1 C–23: Buffer, secondary, T–3	3DA50–433
C–9, C–10, C–14	CAPACITOR, fixed: electrolytic; 2 sect; 35 uf −10% +50% ea sect; 350 vdcw ea sect; JAN type CE52C350P.	C–9 and C–10: Filter, 450 volts C–14: Filter, 150 volts	3DB35–5
C–17	CAPACITOR, fixed: electrolytic; 40 uf −10% +150%; 300 vdcw; JAN type CE31C400N.	Filter, 105 volts	3DB40–76
C–25	CAPACITOR, fixed: electrolytic; 2 sect; 45 uf −10% +150% ea sect; 300 vdcw ea sect; JAN type CE52C450N.	Filter, 85 volts	3DB45–11
C–3	CAPACITOR, fixed: electrolytic; 500 uf −10% +150%; 50 vdcw; JAN type CE51C501G.	Filter, 27 volts	3DB500–38
C–27, C–30	CAPACITOR, fixed: electrolytic; 2000 uf −10% +150%; 15 vdcw; JAN type CE51C202E.	Filters, filament	3DB2000–18
H–1	CLAMP: capacitor mtg	Capacitor holding clamp	6Z1885
O–8, O–9, O–10	CLIP: vibrator	Vibrator holding clip	2Z2712.132
O–1 through O–6	CLIP: capacitor	Capacitor holding clips	2Z2712163
O–7	CLIP: capacitor	Capacitor holding clip	2Z217.162
L–1, L–2, L–4 through L–8, L–10, L–11, L–13 through L–16.	COIL, RF: choke; unshielded	R–F hash filters	3C315–126

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
J-1	CONNECTOR, receptacle: 4 round female cont; straight.	POWER IN connector	2Z3065-96
J-2	CONNECTOR, receptacle: 14 round female cont; straight.	POWER OUT connector	2Z3075-96
H-2	FASTENER, Dzus: 1⅝" lg x 15/16" wd x 5/16" thk o/a.	Panel to case fastener	6Z3809-27
H-3	FASTENER, Dzus: ⅞" lg x ¾" wd x 7/16" thk o/a.	Cover fastener	6Z3809-28
E-4 through E-7	FUSEHOLDER: extractor post type; for single 13/32" x 1½" lg cartridge fuse.	Fuse holders	3Z3282-42.3
F-1, F-2	FUSE, cartridge: 5 amp	F-1: Fuse, relay and filament circuits. F-2: Fuse, 85-volt circuit.	3Z2605.7
F-3, F-4	FUSE, cartridge: 10 amp	F-3: Fuse, 150-volt circuit F-4: Fuse, 450-volt circuit.	3Z2610.1
G-23	GASKET: Buna N or neoprene; single hole; rectangular; 8.35" lg x 6.6" wd x .187" thk o/a.	Panel to case waterproof gasket	3H2154.12-27
G-24	GASKET: JW60 crude rubber compound; single hole; doughnut shape; 4⅛" OD x ⅛" thk x 3⅞" ID.	Fuse cover gasket	3H2154.1-25
E-8	INSULATOR, bushing: round tubr shape; natural, type LTS-H-1 phenolic, per JAN-P-13; 7/16" lg; 5/16" OD, 5/32" ID.	Toroid coil insulating bushing	3G100-142
E-9 through E-14	INSULATOR, bushing: round tubr shape; natural, type LTS-H-1 phenolic; per JAN-P-13; 27/32" lg; .312" OD, .25" ID.	Toroid coil insulating bushings	3G100-143
E-18, E-19	INSULATOR, bushing: round, shouldered type; natural, type LTS-E-4, plastic, per JAN-P-13; .085" lg; .265" OD, .154" ID.	Clip mounting insulating bushings.	3G100-141
E-20	INSULATOR, disk: round W/ears for mtg holes; natural, LTS-E-4 plastic, per JAN-P-13; .031" h; 1⅝" OD, 1.141" ID, two .221" diam mtg holes on 1½" mtg/c.	Clip mounting insulating spacer	3G280-25
E-15	INSULATOR, standoff: round post shape; natural or black, grade LTS-E-4 phenolic, per JAN-P-13; 13/16" lg o/a; 5/16" diam o/a; single #6-32 NC-2 thd x ¼" lg mtd stud.	Wiring terminal post	3G350-106
E-16, E-17	KNOB: lever type; olive drab zinc alloy; for ¼" diam double flatted shaft; single #6-32 thd screw through face of knob, screws into axially tapped hole in end of shaft.	E-16: Switch knob, S-1 E-17: Switch knob, S-2.	2Z5822-422
N-1	LABEL: 14⅛" wd x 18¼" lg x .004" thk	Circuit label	6D16778-2
H-4, H-5	NUT, castellated: ⅜"-32 NS-2	H-4: TRANS POWER switch mounting nut. H-5: OPERATE switch mounting nut.	6L3006-32S
L-3, L-9, L-12	REACTOR: 2 hy, .13 amp; 170 ohms DC resistance; HS metal case.	L-3: Ripple filter, 450-volt circuit. L-9: Ripple filter, 150-volt circuit. L-12: Ripple filter, 85-volt circuit.	3C315-127
O-1	RELAY, armature: 4PST normally open; 12.6 v DC nom; 10 v DC min; 16 v DC max.	Transmit control	2Z7592-103
K-1, K-2	RELAY, thermal: SPST normally closed; operates at 6.9 v DC w/1 amp continuous load; releases at 2 to 3.5 v; heater cur 250 ma w/6.9 v applied.	Overvoltage protection filaments.	2Z7598-129
R-3, R-15, R-19	RESISTOR, fixed: WW; .35 ohm ±10%; 8 w; JAN tvpe RW30GR35.	Transformer current limiting	3RW3602

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
R–27, R–33, R–35	RESISTOR, fixed: comp; 13 ohms ±5%; 1 w; JAN type RC30AE130J.	Voltage dropping, thermal relay heaters.	3RC30AE130J
R–28, R–34	RESISTOR, fixed: comp; 16 ohms ±5%; 1 w; JAN type RC30AE160J.	Voltage dropping, thermal relay heaters.	3RC30AE160J
R–30	RESISTOR, fixed: WW; 16 ohms ±5%; 10 w; JAN type RW31G160.	Voltage dropping, relay supply	3RW13504
R–26, R–32	RESISTOR, fixed: WW; 16 ohms ±5%; 12 w; JAN type RW32G160.	Voltage dropping, filament	3RW13501
R–1, R–13, R–18	RESISTOR, fixed: WW; 20 ohms ±5%; 8 w; JAN type RW30G200.	Vibrator coil current limiting (series drive).	3RW14102
R–2, R–14, R–20	RESISTOR, fixed: WW; 50 ohms ±5%; 8 w; JAN type RW30G500.	Vibrator coil current limiting (shunt drive).	3RW16507
R–23	RESISTOR, fixed: WW; 140 ohms ±5%; 8 w; JAN type RW30G141.	Voltage dropping, 85-volt circuit.	3RW19203
R–22	RESISTOR, fixed: WW; 220 ohms ±5%; 12 w; JAN type RW32G221.	Voltage dropping, 85-volt circuit.	3RW20409
R–21	RESISTOR, fixed: WW; 280 ohms ±5%; 12 w; JAN type RW32G821.	Voltage dropping, 85-volt circuit.	3RW21006
R–6	RESISTOR, fixed: WW; 500 ohms ±5%; 8 w; JAN type RW30G501.	Filter bias	3RW22506
R–16	RESISTOR, fixed: WW; 500 ohms ±5%; 12 w; JAN type RW32G501.	Filter, 150-volt	3RW22508
R–17	RESISTOR, fixed: comp; 620 ohms ±5%; 2 w; JAN type RC40AE621J.	Filter, 105-volt	3RC40AE621J
R–12	RESISTOR, fixed: WW; 9000 ohms ±5%; 12 w.	Bleeder and voltage divider, 450-volt circuit.	3Z6590–27
R–11	RESISTOR, fixed: WW; 22,500 ohms ±5%; 12 w.	Bleeder and voltage divider, 450-volt circuit.	3Z6622E5–7
R–7, through R–10.	RESISTOR, fixed: comp; 100,000 ohms ±10%; 2 w; JAN type RC40AE104K.	Voltage divider and bleeder for 450 volts.	3RC40AE104K
R–4, R–5	RESISTOR, fixed: comp; 1 meg ±10%; 1 w; JAN type RC30AE105K.	Ionization controls	3RC30AE105K
R–24, R–25, R–31.	RESISTOR, thermal; maintains cur between .76 amp and .825 amp over the range of 4 v to 9.5 v; T–9 bulb, 2⅞″ max lg o/a.	Voltage regulation, filaments	3Z6925–3.20
E–21, E–22	SHIELD, tube: bayonet type mtg; .810″ ID x .930″ max OD x 2.250″ h.	Tube shields	2Z8304.172
X–7, X–17	SOCKET, tube: 7 cont miniature; 1 piece saddle mtg; JAN type TSE7T101.	Regulator tube sockets	2Z8677.94
X–1, X–8, X–10	SOCKET, tube: 7 cont small; 1 piece molded in mtg plate.	Vibrator sockets	2Z8677.153
X–2 through X–6, X–9, X–11 through X–16, X–18, X–19.	SOCKET, tube: octal; 1 piece molded in mtg plate.	X–2: Tube socket, V–1 X–3: Tube socket, V–2. X–4: Socket, C–3. X–5: Socket, C–9. X–6: Socket, C–10. X–9: Socket, C–14. X–11: Socket, R–24. X–12: Socket, R–25. X–13: Socket, R–31. X–14: Socket, K–1. X–15: Socket, K–2. X–16: Socket, C–25. X–18: Socket, C–27. X–19: Socket, C–30.	2Z8678.337
O–15 through O–20.	SPRING: loop type; for Dzus fastener; 1⅜″ lg x 5/32″ wd x .08 thk o/a.	Panel to case fastener strikes	6Z8377–10
O–21, O–22	SPRING: loop type; strike for Dzus fastener; 1⅛″ lg x ⅜″ wd x .062″ thk o/a.	Cover fastener, strikes	6Z8377–2

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
S-1	SWITCH, rotary: 4 pole, 3 position; 2 sect, ea sect c/o 2 snap sw mtd on metal plate.	OPERATE switch	3Z9825-62.503
S-2	SWITCH, rotary: 4 pole, 3 position; 2 sect, 1 wafer and 1 snap sw sect.	TRANS POWER switch	3Z9825-62.502
T-1	TRANSFORMER, power: vibrator; input 12.6 v DC, 3.45 amp CT; output secd #1, 640 v at 100 ma CT; secd #2, 58 v at 2 ma CT: 115 cyc output; HS metal case.	300-volt section transformer	2Z9625-73
T-2	TRANSFORMER, power: input 12.6 v DC at 2.55 amp CT; output secd 405 v CT, 140 ma; 115 cyc output; HS metal case.	150-volt section transformer	2Z9625-74
T-3	TRANSFORMER, power: vibrator; input 12.6 v DC, 1.6 amp CT; output secd #1 248 v at .09 amp CT; secd #2, 1 v at 2.4 amp; 115 cyc output; HS metal case.	85-volt section transformer	2Z9625-75
V-3	TUBE, electron: JAN-OA2	Voltage regulator, 150-volt supply.	2JOA2
V-4	TUBE, electron: JAN-OB2	Voltage regulator, 85-volt supply.	2JOB2
V-1, V-2	TUBE, electron: JAN-1007	Rectifiers, 450-volt supply	2J1007
E-1, E-2, E-3	VIBRATOR, synchronous: input 6.3 v DC, 4.3 amp.	E-1: Vibrator, 450-volt supply. E-2: Vibrator, 150-volt supply. E-3: Vibrator, 85-volt supply.	3H6690-15

2. Identification Table of Parts for Power Supply PP-112/GR

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
	POWER SUPPLY PP-112/GR: vibrator and electronic type; sync; outputs 6.3 v DC, 595 ma; 6.3 v DC, 1415 ma; 5.6 v DC, 431 ma; −27 v DC, 2 ma; 85 v DC, 71 ma; 105 v DC, 20 ma; 150 v DC, 37.5 ma, 250 v DC, 11.5 ma; 450 v DC, 75 ma; input 25.2 v DC; 7 amp.		3H4497-112
(Order through AGO channels.)	TECHNICAL MANUAL (TM 11-5036).		
C-19, C-21, C-24	CAPACITOR, fixed: mica; 1000 uuf ±10%; 500 vdcw; JAN type CM25B102K.	R-F hash filters	3K2510221
C-1, C-12, C-18, C-20, C-22.	CAPACITOR, fixed: ceramic; 3000 uuf ±20%; 500 vdcw.	R-F hash filters	3DA3-137
C-11	CAPACITOR, fixed: paper; 3000 uuf ±20%; 1000 vdcw; JAN type CP28A1EG302M.	R-F hash filters	3DA3-138
C-4 through C-8, C-15, C-16, C-26, C-28, C-29, C-31.	CAPACITOR, fixed: ceramic; 5000 uuf ±20%; 500 vdcw.	R-F hash filters	3DA5-215
C-2, C-13, C-23	CAPACITOR, fixed: paper; 1 uf ±10%; 600 vdcw; JAN type CP69B1EF105K.	C-2: Buffer, primary, T-1. C-13: Buffer, primary, T-2. C-23: Buffer, primary, T-3.	3DB1-219
C-9, C-10, C-14	CAPACITOR, fixed: electrolytic; 2 sect; 35 uf −10% +150% ea sect; 350 vdcw ea sect; JAN type CE52C350P.	C-9: Filter, 450 volts. C-10: Filter, 450 volts. C-14: Filter, 150 volts.	3DB35-5
C-17	CAPACITOR, fixed; electrolytic; 40 uf −10% +150%; 300 vdcw; JAN type CE31C400N.	Filter, 105 volts	3DB40-76
C-25	CAPACITOR, fixed: electrolytic; 2 sect; 45 uf −10% +150% ea sect; 300 vdcw ea sect; JAN type CE52C450N.	Filter, 85 volts	3DB45-11

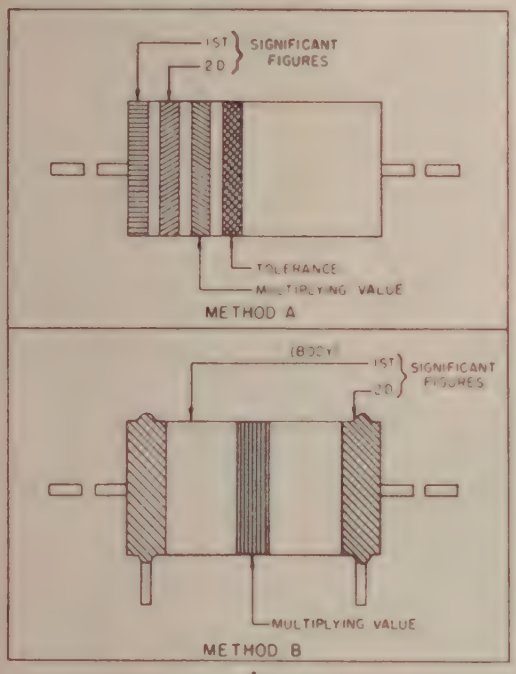
Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
C–3	CAPACITOR, fixed: electrolytic; 500 uf −10% +150%; 50 vdcw; JAN type CE51C601G.	Filter, 27 volts	3DB500–38
C–27, C–30	CAPACITOR, fixed: electrolytic; 2000 uf −10% +150%; 15 vdcw; JAN type CE51C202E.	Filters, filament	3DB2000–18
H–1	CLAMP: capacitor mtg	Capacitor holding clamp	6Z1885
O–1 through O–6	CLIP: capacitor (for holding capacitor in socket).	Capacitor holding clips	2Z2712.163
O–7	CLIP: capacitor	Capacitor holding clip	2Z2712.162
O–8, O–9, O–10	CLIP: vibrator	Vibrator holding clips	2Z2712.132
L–1, L–2, L–4 through L–8, L–10, L–11, L–13 through L–16.	COIL, RF: choke; unshielded	R–F hash filters	3C315–126
J 1	CONNECTOR, receptacle: 4 round female cont; straight.	POWER IN connector	2Z3065–96
J 2	CONNECTOR, receptacle: 14 round female cont; straight.	POWER OUT connector	2Z3075–26
H 2	FASTENER, Dzus: 1⅝″ lg x 15/16″ wd x 5/16″ thk o/a.	Panel to case fastener	6Z3809–27
H 3	FASTENER, Dzus: ⅞″ lg x ¾″ wd x 7/16″ thk o/a.	Cover fastener	6Z3809–28
E 4, E–5, E–6, E 7.	FUSEHOLDER: extractor post type; for single 13/32″ x 1½″ lg cartridge fuse.	Fuse holders	3Z3282–42.3
F 2	FUSE, cartridge: 3 amp	Fuse, 85-volt circuit	3Z2603.19
F–1, F–3, F–6	FUSE, cartridge: 5 amp	F–1: Fuse, relay and filament circuits. F–3: Fuse, 150-volt circuit. F–4: Fuse, 450-volt circuit.	3Z2605.7
O 24	GASKET: JW60 crude rubber compounds	Cover gasket	3H2154.1–25
O 23	GASKET: Buna N or neoprene	Panel to case waterproof gasket	3H2154.12–27
E 18, E 19	INSULATOR, bushing: round shouldered type; natural, LTS–E–4 plastic, per JAN–P–13; .085″ lg; .265″ OD, .154″ ID.	Clip mounting insulating bushings.	3G100–141
E 8	INSULATOR, bushing: round tubr shape; natural, type LTS–H–1 phenolic, per JAN–P–13; 7/16″ lg; 5/16″ OD, 5/32″ ID.	Toroid coil insulating bushing	3G100–142
E 9 through E 14	INSULATOR, bushing: round tubr shape; natural, type LTS–H–1 phenolic, per JAN–P–13; 27/32″ lg; .312″ OD, .25″ ID.	Toroid coil insulating bushings	3G100–143
E 20	INSULATOR, disk: round w/ears for mtg holes; natural, LTS–E–4 plastic, per JAN–P–13; .031″ h; 1⅝″ OD; 1.141″ ID.	Clip mounting insulator spacer	3G280–25
E 15	INSULATOR, standoff: round post shape; natural or black, grade LTS–E–4 phenolic, per JAN–P–13; 13/16″ lg o/a; 5/16″ diam o/a, single #6–32 NC–2 thd x ¼″ lg mtg stud.	Wiring terminal post	3G350–106
E–16, E 17	KNOB: lever type; olive drab zinc alloy; for ¼″ double flatted shaft.	E–16: Switch knob, S–1 E–17: Switch knob, S–2	2Z5822–422
N 1	LABEL: 14⅛″ wd x 18¼″ lg x .004″ thk	Circuit label	6D16778–1
H–4, H–5	NUT, castellated: ⅜″–32 NS–2	H–4: TRANS POWER switch mounting nut. H–5: OPERATE switch mounting nut.	6L3006–32S
L–3, L–9, L–12	REACTOR: 2 hy, .13 amp; 170 ohm DC resistance HS metal case.	L–3: Ripple filter, 450-volt circuit. L–9: Ripple filter, 150-volt circuit. L–12: Ripple filter, 85-volt circuit.	3C315–127

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
O–1	RELAY, armature: 4PST normally open; 25.2 v DC nom, 20 v DC min, 32 v DC max.	Transmit control	2Z7592–102
K–1, K–2	RELAY, thermal: SPST normally closed; operates at 6.9 v DC w/1 amp continuous load, releases at 2 to 3.5 v, heater cur 250 ma w/6.9 v applied.	Overvoltage protection, filaments.	2Z7598–129
R–3, R–15, R–19	RESISTOR, fixed: WW; 2 ohms ±5%; 16 w; JAN type RW32G2RO.	Transformer current limiting	3RW8101
R–36	RESISTOR, fixed: WW; 4 ohms ±5%; 12 w; JAN type RW32G4RO.	Voltage dropping, transmitter filament.	3RW9901
R–39	RESISTOR, fixed: WW; 9 ohms ±5%; 12 w; JAN type RW32G9RO.	Voltage dropping, receiver filament.	3RW12007
R–27, R–33, R–35	RESISTOR, fixed: comp; 13 ohms ±5%; 1 w; JAN type RC30AE130J.	Voltage dropping, thermal relay heaters.	3RC30AE130J
R–28, R–34	RESISTOR, fixed: comp; 16 ohms ±5%; 1 w; JAN type RC30AE160J.	Voltage dropping, thermal relay heaters.	3RC30AE160J
R–26, R–32	RESISTOR, fixed: WW; 16 ohms ±5%; 12 w; JAN type RW32G160.	Voltage dropping, filaments	3RW13501
R–30	RESISTOR, fixed: WW; 45 ohms ±5%; 18 w; JAN type RW33G450.	Voltage dropping, relay supply	3RW16212
R–23	RESISTOR, fixed: WW; 140 ohms ±5%; 8 w; JAN type RW30G141.	Voltage dropping, 85-volt circuit.	3RW19203
R–22	RESISTOR, fixed: WW; 220 ohms ±5%; 12 w; JAN type RW32G221.	Voltage dropping, 85-volt circuit.	3RW20409
R–21	RESISTOR, fixed: WW; 280 ohms ±5%; 12 w; JAN type RW32G281.	Voltage dropping, 85-volt circuit.	3RW21006
R–6	RESISTOR, fixed: WW; 500 ohms ±5%; 8 w; JAN type RW30G501.	Filter, bias	3RW22506
R–16	RESISTOR, fixed: WW; 500 ohms ±5%; 12 w; JAN type RW32G501.	Filter, 150 volts	3RW22508
R–17	RESISTOR, fixed: comp; 620 ohms ±5%; 2 w; JAN type RC40AE621J.	Filter, 105 volts	3RC40AE621J
R–12	RESISTOR, fixed: WW; 9000 ohms ±5%; 12 w.	Bleeder and voltage divider, 450-volt circuit.	3Z6590–27
R–11	RESISTOR, fixed: WW; 22,500 ohms ±5%; 12 w.	Bleeder and voltage divider, 450-volt circuit.	3Z6622E5–7
R–7 through R–10.	RESISTOR, fixed: comp; 100,000 ohms ±10%; 2 w; JAN type RC40AE104K.	Voltage dividers and bleeders for 450 volts.	3RC40AE104K
R–4, R–5	RESISTOR, fixed: comp; 1 meg ±10%; 1 w; JAN type RC30AE105K.	Ionization controls	3RC30AE105K
R–24, R–25, R–31, R–37, R–38, R–40.	RESISTOR, thermal: maintains cur between .76 amp and .825 amp over range of 4 to 9.5 v; T–9 bulb, 2⅞″ lg o/a.	Voltage regulation, filaments	3Z6925–3.20
E–21, E–22	SHIELD, tube: bayonet type mtg; .810″ ID x .930″ max OD x 2.250″ h.	Tube shields	2Z8304.172
X–7, X–17	SOCKET, tube: 7 cont miniature; 1 piece saddle mtg; JAN type TSE7T101.	Regulator tube sockets	2Z8677.94
X–1, X–8, X–10	SOCKET, tube: 7 cont small; 1 piece molded in mtg plate.	Vibrator sockets	2Z8677.153
X–2 through X–6, X–9, X–11 through X–16, X–18 through X–22.	SOCKET, tube: octal; 1 piece molded in mtg plate.	X–2: Tube socket, V–1. X–3: Tube socket, V–3. X–4: Socket, C–3. X–5: Socket, C–9. X–6: Socket, C–10. X–9: Socket, C–14. X–11: Socket, R–24. X–12: Socket, R–25. X–13: Socket, R–31. X–14: Socket, K–1. X–15: Socket, K–2.	2Z8678.337

Ref. symbol	Name of part and description	Function of part	Signal Corps stock No.
		X–16: Socket, C–25. X–18: Socket, C–27. X–19: Socket, C–30. X–20: Socket, R–37. X–21: Socket, R–38. X–22: Socket, R–40.	
O–15 through O–20.	SPRING: loop type; for Dzus fastener; 1⅜″ lg x 5/32″ wd x .08″ thk o/a.	Panel to case fastener strike	6Z8377–10
O–21, O–22	SPRING: loop type; 1⅛″ lg x ⅜″ wd x .062″ thk o/a.	Cover fastener strikes	6Z8377–9
S–1	SWITCH, rotary: 4 pole, 3 position; 2 sect, ea w/2 snap sw mtd on metal plate.	OPERATE switch	3Z9825–62
S–2	SWITCH, rotary: 4 pole, 3 position; 2 sect, 1 wafer and 1 snap sw sect.	TRANS POWER switch	3Z9825–62.502
T–1	TRANSFORMER, power: vibrator; input 25.2 v DC, 1.63 amp CT; output secd #1 620 v CT at .1 amp; secd #2 56 v CT at 2 ma; 115 cyc output; HS metal case.	300-volt section transformer	2Z9625–71
T–2	TRANSFORMER, power: vibrator; input 25.2 v DC, 1.33 amp CT; output secd 405 v CT at .14 amp; 115 cyc output; HS metal case.	150-volt section transformer	2Z9625–70
T–3	TRANSFORMER, power: vibrator; input 25.2 v DC, .7 amp CT; output secd #1, 240 v CT at .09 amp; secd #2, 1 v at 2.4 amp; 115 cyc output; HS metal case.	85-volt section transformer	2Z9625–72
V–3	TUBE, electron: JAN–0A2	Voltage regulator, 150-volt supply.	2J0A2
V–4	TUBE, electron: JAN–0B2	Voltage regulator 85-volt supply.	2J0B2
V–1, V–2	TUBE, electron: JAN–1007	Rectifiers, 450-volt supply	2J1097
E–1, E–2, E–3	VIBRATOR, synchronous: input 25.2 v DC; 1.3 amp.	E–1: Vibrator, 450-volt supply. E–2: Vibrator, 150-volt supply. E–3: Vibrator, 85-volt supply.	3H6690–16

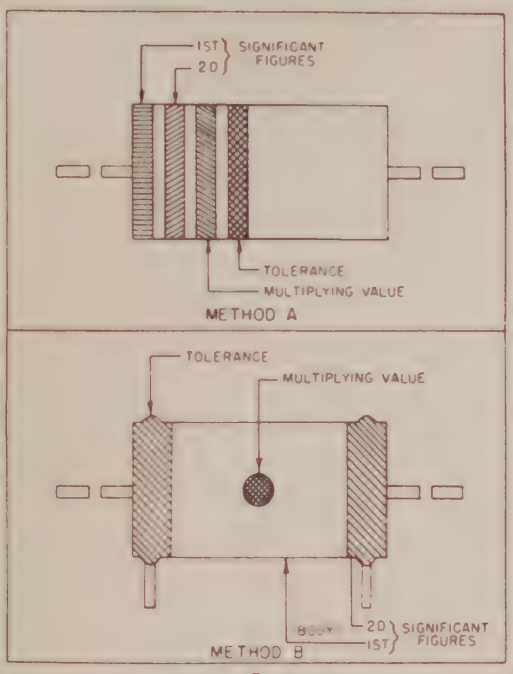
RESISTOR COLOR CODES

RMA COLOR CODE FOR FIXED COMPOSITION RESISTORS*



A

JAN COLOR CODE FOR FIXED COMPOSITION RESISTORS†



B

COLOR	SIGNIFICANT FIGURE	MULTIPLYING VALUE	TOLERANCE (%)
BLACK	0	1	± -
BROWN	1	10	± 1
RED	2	100	± 2
ORANGE	3	1,000	± 3
YELLOW	4	10,000	± 4
GREEN	5	100,000	± 5
BLUE	6	1,000,000	± 6
VIOLET	7	10,000,000	± 7
GRAY	8	100,000,000	± 8
WHITE	9	1,000,000,000	± 9
GOLD	—	0.1	± 5
SILVER	—	0.01	± 10
NO COLOR	—	—	± 20

NOTES

* INSULATED FIXED COMPOSITION RESISTORS WITH AXIAL LEADS ARE DESIGNATED BY A NATURAL TAN BACKGROUND COLOR. NON-INSULATED FIXED COMPOSITION RESISTORS WITH AXIAL LEADS ARE DESIGNATED BY A BLACK BACKGROUND.

† RESISTORS WITH AXIAL LEADS ARE INSULATED. RESISTORS WITH RADIAL LEADS ARE NON-INSULATED.

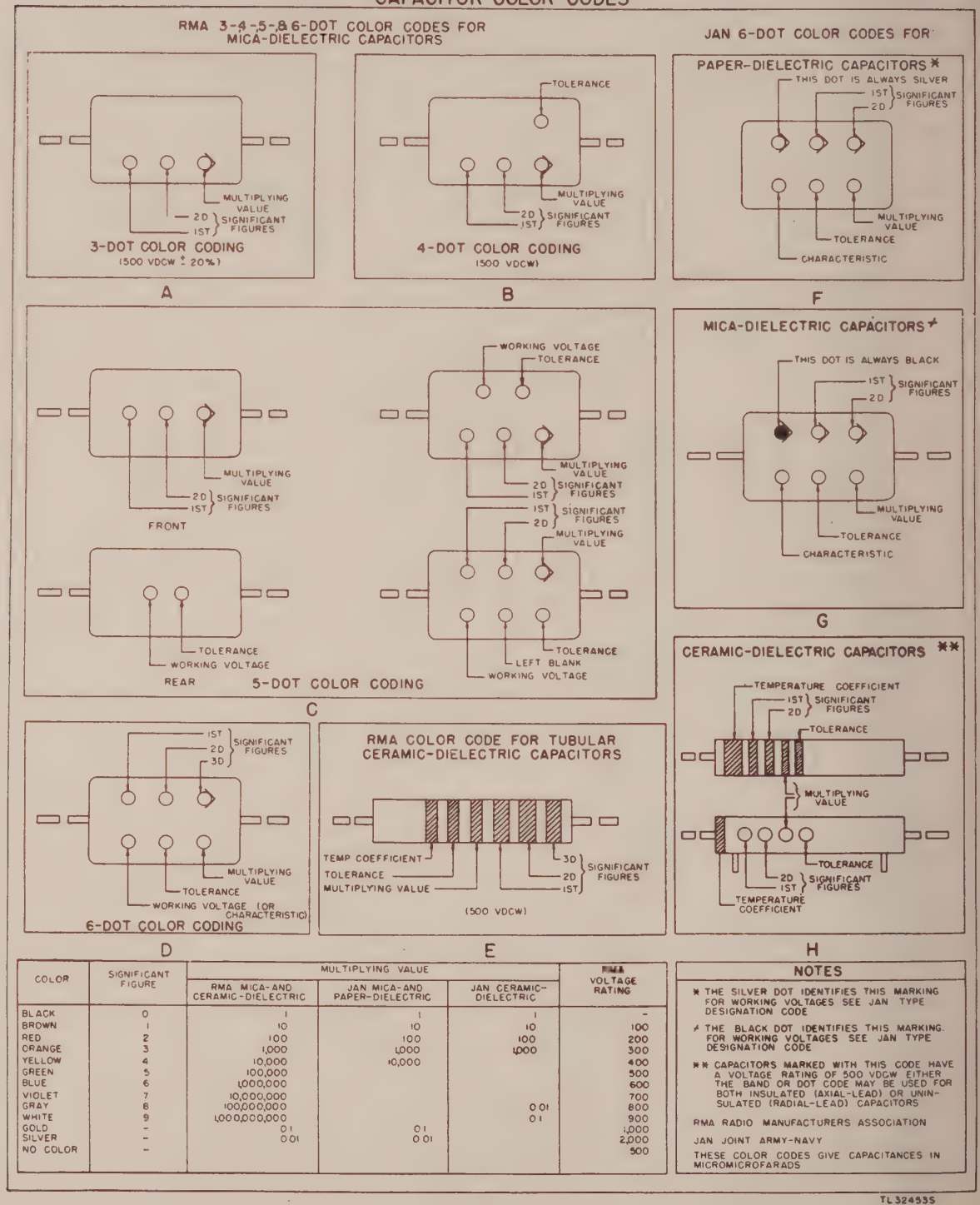
RMA RADIO MANUFACTURERS ASSOCIATION

JAN JOINT ARMY-NAVY

THESE COLOR CODES GIVE ALL RESISTANCE VALUES IN OHMS

TL32454S

Figure 15. Resistor color codes.



COLOR	SIGNIFICANT FIGURE	MULTIPLYING VALUE			RMA VOLTAGE RATING
		RMA MICA- AND CERAMIC-DIELECTRIC	JAN MICA- AND PAPER-DIELECTRIC	JAN CERAMIC-DIELECTRIC	
BLACK	0	1	1	1	-
BROWN	1	10	10	10	100
RED	2	100	100	100	200
ORANGE	3	1,000	1,000	1,000	300
YELLOW	4	10,000	10,000		400
GREEN	5	100,000			500
BLUE	6	1,000,000			600
VIOLET	7	10,000,000			700
GRAY	8	100,000,000		0.01	800
WHITE	9	1,000,000,000		0.1	900
GOLD	-	0.1	0.1		1,000
SILVER	-	0.01	0.01		2,000
NO COLOR	-				500

NOTES

* THE SILVER DOT IDENTIFIES THIS MARKING FOR WORKING VOLTAGES SEE JAN TYPE DESIGNATION CODE

THE BLACK DOT IDENTIFIES THIS MARKING FOR WORKING VOLTAGES SEE JAN TYPE DESIGNATION CODE

** CAPACITORS MARKED WITH THIS CODE HAVE A VOLTAGE RATING OF 500 VDCW EITHER THE BAND OR DOT CODE MAY BE USED FOR BOTH INSULATED (AXIAL-LEAD) OR UNINSULATED (RADIAL-LEAD) CAPACITORS

RMA RADIO MANUFACTURERS ASSOCIATION

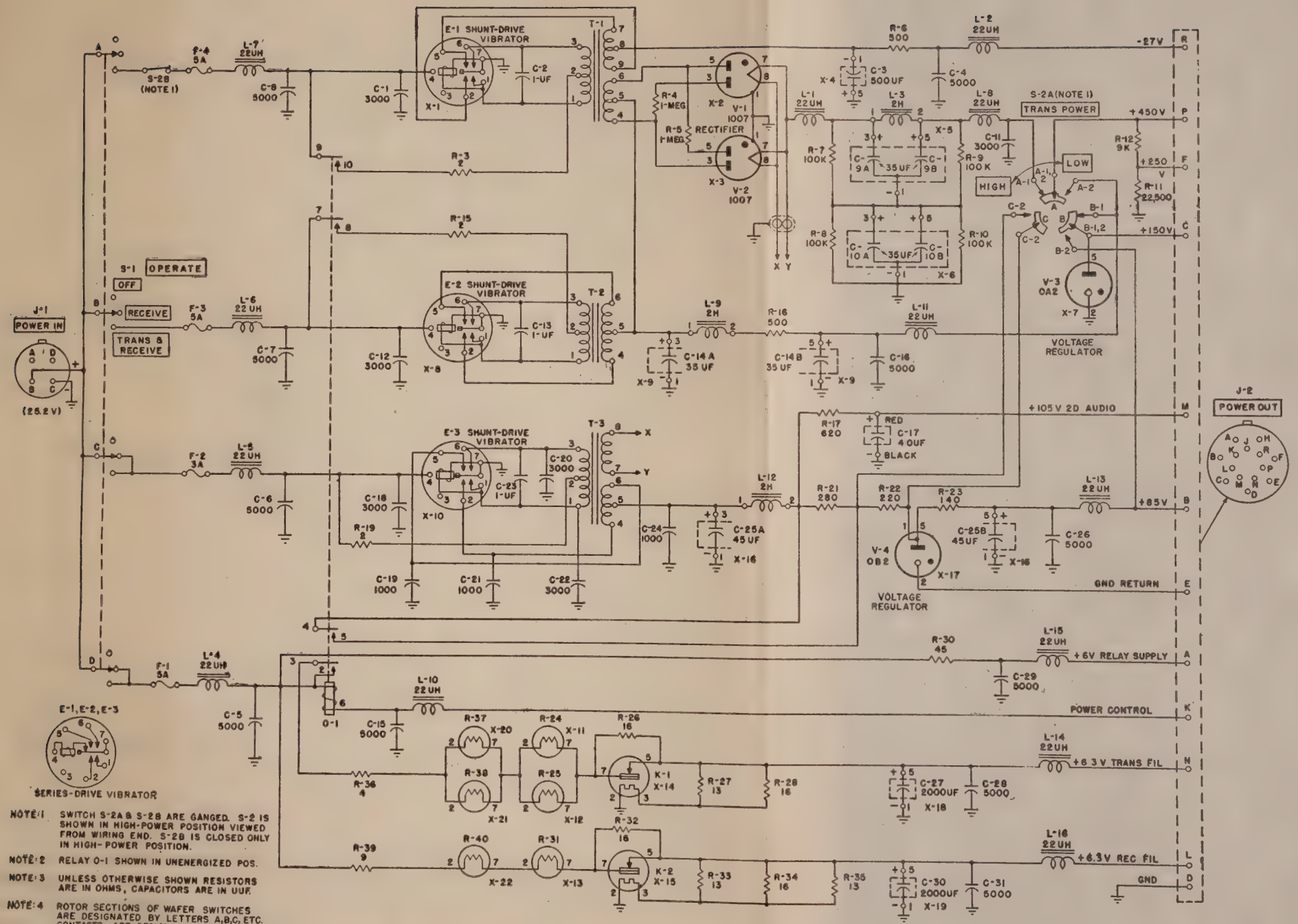
JAN JOINT ARMY-NAVY

THESE COLOR CODES GIVE CAPACITANCES IN MICROMICROFARADS

TL 32453S

Figure 16. Capacitor color codes.

☆ U. S. GOVERNMENT PRINTING OFFICE: 1951-929598



NOTE 1 SWITCH S-2A & S-2B ARE GANGED. S-2 IS SHOWN IN HIGH-POWER POSITION VIEWED FROM WIRING END. S-2B IS CLOSED ONLY IN HIGH-POWER POSITION.

NOTE 2 RELAY O-1 SHOWN IN UNENERGIZED POS.

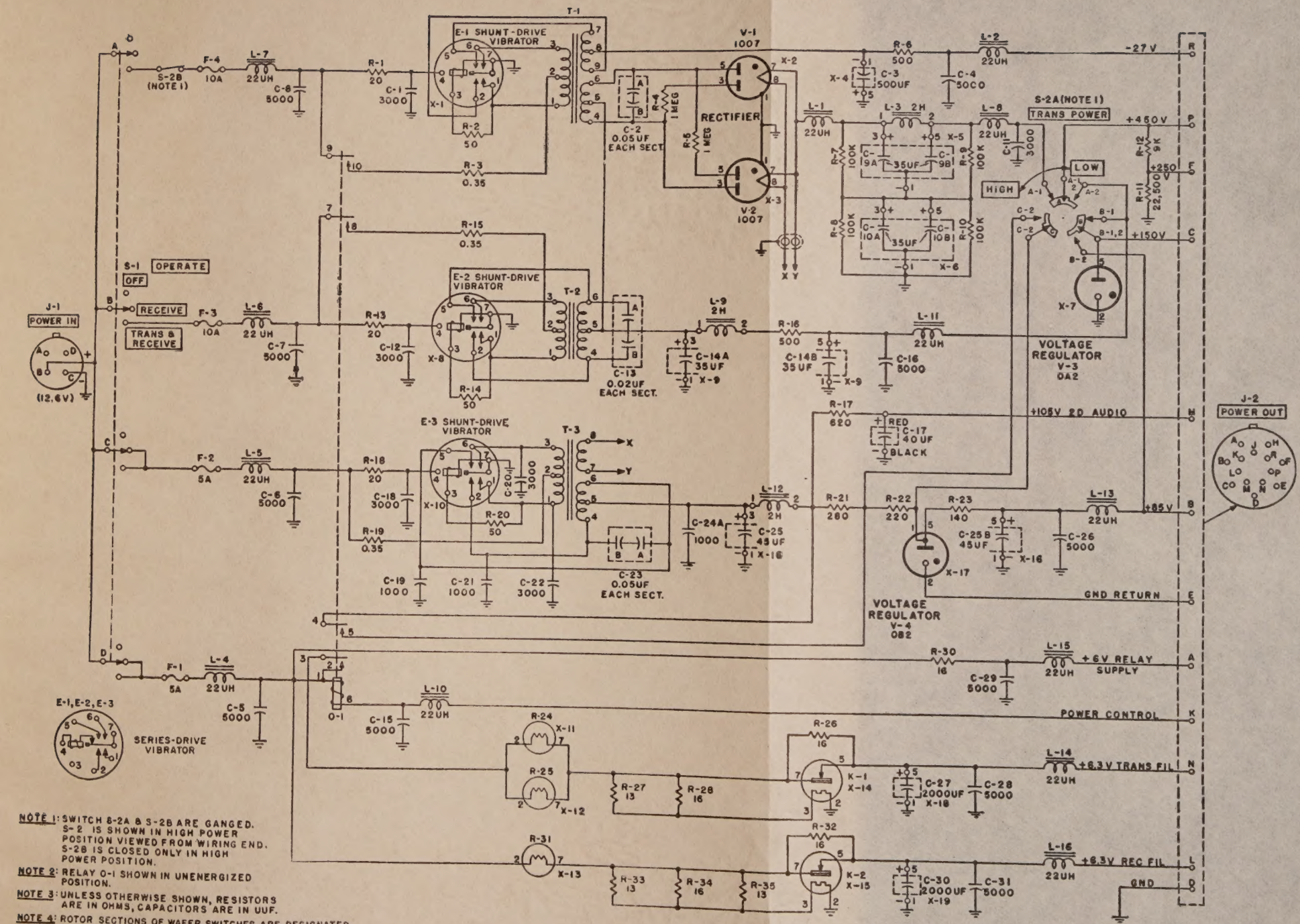
NOTE 3 UNLESS OTHERWISE SHOWN RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.

NOTE 4 ROTOR SECTIONS OF WAFER SWITCHES ARE DESIGNATED BY LETTERS A,B,C, ETC. CONTACTS ARE DESIGNATED BY A LETTER AND A NUMBER. THE LETTER INDICATES THE ROTOR SECTION THROUGH WHICH THE CONTACTS COMPLETE A CIRCUIT; THE NUMBER INDICATES THE SWITCH POSITION IN WHICH THE CONTACT IS IN A COMPLETED CIRCUIT. THE LETTERS AND NUMBERS DO NOT APPEAR ON THE EQUIPMENT BUT ARE USED ONLY ON SCHEMATIC DIAGRAMS.

NOTE 5 VOLTAGE READINGS ARE TAKEN UNDER NORMAL LOAD CONDITIONS.

TM 5036-17

Figure 17. Power Supply PP–112/GR, schematic diagram.



NOTE 1: SWITCH S-2A & S-2B ARE GANGED. S-2 IS SHOWN IN HIGH POWER POSITION VIEWED FROM WIRING END. S-2B IS CLOSED ONLY IN HIGH POWER POSITION.

NOTE 2: RELAY O-1 SHOWN IN UNENERGIZED POSITION.

NOTE 3: UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.

NOTE 4: ROTOR SECTIONS OF WAFER SWITCHES ARE DESIGNATED BY LETTERS A, B, C, ETC. CONTACTS ARE DESIGNATED BY A LETTER AND A NUMBER. THE LETTER INDICATES THE ROTOR SECTION THROUGH WHICH THE CONTACTS COMPLETE A CIRCUIT; THE NUMBER INDICATES THE SWITCH POSITION IN WHICH THE CONTACT IS IN A COMPLETED CIRCUIT. THE LETTERS AND NUMBERS DO NOT APPEAR ON THE EQUIPMENT BUT ARE USED ONLY ON SCHEMATIC DIAGRAMS.

NOTE 5: VOLTAGE READINGS ARE TAKEN UNDER NORMAL LOAD CONDITIONS.

TM 5036-18

Figure 18. Power Supply PP–109/GR, schematic diagram.